

August 4, 1958

# Aviation Week

*Including Space Technology*

75 cents

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**USAF Changes  
Philosophy On  
Flight Testing**



Rocketdyne Engines for Atlas B

## Bomarc Sales Drive Focuses on NATO Nations



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Countless eyes in the technical research world today are focused on the Strickland Process, exclusive with Brunswick. This is a fully mechanical method of producing reinforced fiberglass laminates. Recent experiences with it indicate a bright area of promise in meeting the problems involved in re-entry.

Much current interest centers on an SR-70 produced radome's ability to withstand under stress a high temperature jet stream for a substantial number of minutes. Yet this is only indicative of many new areas under relentless and costly attack by highly skilled Brunswick research and development teams.

New Brunswick materials and techniques are also available to answer your problems in design, fabrication and testing of aircraft components in metal honeycomb and conventional metalwork. Write: The Brunswick-Bulke-Cellender Co., Defense Products Div., 1790 Menden St., Muskegon, Michigan.

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Figure 1—sugar-scoop made by R. H. Gilchrist Mfg. Company, Los Angeles

## MAGNESIUM "SUGAR SCOOP" HELPS REGULUS II BREATHE

*Large thin-wall magnesium casting augments appetite for air*

At experience spends more than ten miles above the earth, Chance Vought Aircraft's Regulus II requires enormous quantities of air through a 750 lb. magnesium casting. This complex, close tolerance magnesium casting supplies air for the Regulus' powerful J-79 jet engine. It also provides ducting for boundary layer control and for air conditioning. Normal thickness on walls and webs is .004 inch and the solid leading edge tapers to a 6-005 inch exit radius. Casting tolerance is  $\pm .001$  inch on dimensions up to 12 inches, with an additional  $\pm .001$  inch per inch

on dimensions above that. That's not casting accuracy! This air scoop is an excellent example of the versatility and workability of magnesium alloy castings in aircraft design. Thin-wall casting design can be produced in magnesium to replace complicated, costly fabrications involving several production operations.

For more information about magnesium mold castings and their use in aircraft design, contact your nearest magnesium supplier or Dow sales office.



MAGNESIUM DESIGNER, a 320-page handbook, discusses in detail properties, structural design, profile design including airfoils and mold products, fabrication and finishing. Large variety of tables on properties, stress, tolerances, etc. See your nearest office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 34420-1.

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## AVIATION CALENDAR

- Aug. 6—Speed Technical Conference in San Lucas, Magdalena and Venezuela; 100 pilots sponsored by the American Institute of Electrical Engineers (AIEE) Stiller, Los Angeles, Calif.
- Aug. 7—Aircraft Conference, American Society for Quality Control, Western Division, El Centro Hotel, San Diego, Calif.
- Aug. 7—National Conference, OAC Club of America, Hotel Statler, Los Angeles
- Aug. 7-15—Modern Developments in Heat Transfer, Continuous Course, University of Wisconsin, Minneapolis, Minn.
- Aug. 13-15—Conference on Electronic Standards and Measurements, National Bureau of Standards, Boulder, Colorado
- Aug. 13-15—Aircraft Conference, American Institute of Electrical Engineers and Institute of Radio Engineers
- Aug. 13-15—Seventh Annual Conference, Industrial Applications of X-ray Analysis, Union Hotel, Denver, Colo.
- Aug. 14-21—North Atlantic Aviation, Boeing, Seattle, Wash.; Convair, Concord, Wash.; Ford, Grand Rapids, Mich.
- Aug. 15-16—Visiting Engineers Research Engineering Seminar, Pennsylvania State University, University Park, Pa.
- Aug. 18-19—Annual O'Brien Regional Meeting, American Nuclear Society, Sheraton Hotel, Anaheim, Calif.
- Aug. 19-21—Pacific General Meeting, American Institute of Electrical Engineers, Hotel Seattle, Seattle, Wash.
- Aug. 19-21-23—Pacific Electronic Show & Convention, Institute of Radio Engineers, Sheraton Hotel, Los Angeles, Calif.
- Aug. 22-27—Third Annual Convention, National Flying Club, New Hollywood, Hollywood Hotel, Hollywood, Calif.
- Aug. 23-25—Second Symposium on Naval Hydrodynamics, Washington, D. C.

(Continued on page 6)

## AVIATION WEEK (including Space Technology)

August 4, 1958  
Vol. 45, No. 2

Each week this magazine has a special feature in the form of a special report on the latest developments in the field of aviation. This report is written by a leading expert in the field and is one of the most authoritative and up-to-date sources of information available to the aviation engineer. The report is written in a clear, concise, and readable style, and is one of the most valuable features of the magazine. The report is written by a leading expert in the field and is one of the most authoritative and up-to-date sources of information available to the aviation engineer. The report is written in a clear, concise, and readable style, and is one of the most valuable features of the magazine.

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## HOW Blind Nuts SAVE MANHOURS ON THE DC-8



BS436 BLIND NUT

The Blind Nut was selected by cost-conscious Douglas engineers for use as a nutplate to attach the wing-fuel and integral tanks to all exterior fuselage doors and emergency exit panels of the cabin-pressurized DC-8 luxury jetliner because of its simplicity and faster installation.

Each Blind Nut is installed in a single hole, in one operation, and at a rate of about ten per minute compared to two additional countermach holes required for the installation of two sheets to attach each nutplate.

Considering that each door on the DC-8 has several hundred or more Blind Nuts, a substantial number of manhours will be saved on each production airplane when compared to the additional drilling and riveting time required to install conventional nutplates.

Standard steel Blind Nuts are being used on aircraft and missiles at temperatures up to 300° F. in production and repair applications. They are quickly installed with a hand-held, hydraulically actuated gun. Blind Nuts are available in grip lengths of 1/16" increment and ring in screw sizes from 4-60 through 3/8-24.

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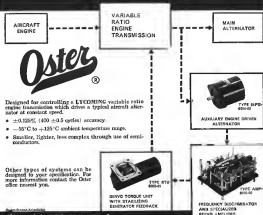




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Engineers For Advanced Projects

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One of GPL's ground speed and drift angle measuring equipments, AN/APN-86, provides basic speed information to computers which tell the

Pilot WB-50s exactly where they are every flight second.

GPL's data computers give an instantaneous and continuous display: Ground Speed and Drift Angle, Wind Speed and Direction, Latitude and Longitude, Shortest Course To Destination, Heading Signal To Pilot (or autopilot).

The systems were developed for the Air Force (W-50s). They are the result of an achievement comparable in magnitude to the breaking of the sound barrier. GPL's use of the Doppler effect to air navigation.

The results of these GPL systems extend to every area of flight. Their use and potential has just begun to be explored.



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**AIRCRAFT INSTRUMENTS** Staves: a new Czech Avionics Division now enjoys a leading edge through unprecedented sensitivity, accuracy and repeat ability. At 40,000 feet, it detects a four degree... in contrast to 40 feet. Safety is important in traffic control and flight crew difficult to be it. As a control instrument, it is essential to maintain in quality condition.

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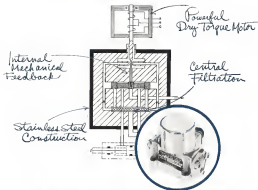


**INTRA RED COMPONENTS:** Below infra-red cells are designed to specifically perturb the electron transport system. Below important production processes increase yield and product activity. Other infra-red developments include fiber optics and thermistor technology, as well as advanced research in laser and non-invasive tests.



**PHOTOGRAPHIC SYSTEMS** Luma's new high performance 70mm zoom-camera designs & form-factors, and pulse operation... with 100 frames per second in 1/4000 sec. From the smallest 16mm gun camera we built to units of 50" in size, feature developments include hybrid film recording and instrumentation, and special sequence cameras.

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Conventional bolts were not strong enough to foster Jet Age aircraft now in drawing books. So Standard Preset Steel Co. developed vibration fastener, compressors, materials and production techniques and designed a high-strength bolt—the Hi Psi EWN-22—strongest bolt made in this time.

Compared with conventional 160,000 psi bolts like the MS 20004 Series, the SPS EWN-22 has 39% greater static strength and, at 8 million stress cycles, up to 96% greater fatigue strength. These qualities make it feasible, in most cases, to replace a standard MS 20004 Series bolt with an EWN-22 of the *same* diameter. The benefits from use of the EWN-22 are increased structural strength and safety and its reduced weight—are obvious.

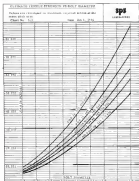
Concomitantly with the development of the EWN-22, SPS produced the Hi Psi EWN-22 locknut to complement the bolt. It is a high tensile strength self-locking nut with a 12-point external wrenching surface. It makes possible the high wrenching torque needed to preload the EWN-22 to its greatest advantage.

Along with Hi Psi EWN-22 bolts and EWN-22 locknuts come other additions to the complete SPS line of threaded aircraft fasteners—PLI-22 gas-load indicating washers, single mechanical devices for accurately preloading the high strength bolts. For detailed information about these products—or about your special aircraft threaded fastener problem—write today: Aircraft/Naval Division, STANDARD PRESET STEEL CO., Jenkintown 3, Pa.

Hi Psi aircraft fasteners provide a vibration problem-free solution for your fleet.

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• Hi Psi Nut Co. • 11500 E. 1st Ave., Suite 200, Denver, CO 80231

**EWN-22 is much stronger** than conventional strength bolts. These data will show ultimate tensile strength in pounds (thousand) and ultimate torque in foot-pounds (thousand) for EWN-22 one inch diameter. The EWN-22 is stronger in shear and in fatigue as well.



## Lord Tempproof Mountings

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Select your vibration isolators for avionics electronic equipment from the only complete line—Lord Tempproof Mountings.

Tempproof Mountings provide:

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Tempproof Mountings are available in individual isolators or as component parts of complete mounting base assemblies. Full information is contained in Bulletin 310, available from your nearest Lord Field Engineer or the Home Office, Erie, Pa.



All-Attitude Tempproof Mountings—easy to install in any position, installed or later, without disassembly. Two sizes—3 and 5 in.—with load ratings from 10 to 5 pounds per mounting.

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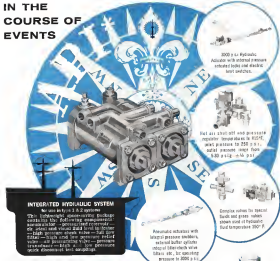
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## EDITORIAL

### Mid-Summer Survey

The aviation industry and its related technologies are standing through the renaissance months in one of the strongest stratospheres since the first years after the end of World War II.

The Mid-East crisis seems dangerously close to a shooting war in stark contrast to a domestic calm and conspiracy that is hard to explain.

Although U.S. science and industry are on the verge of some of their most exciting explorations of space, the general public appears bored with the entire subject.

The industrial structure on which the Pentagon depends to develop and produce weapons is new weapons systems is creating and growing under severe financial stress but even the top civilian leaders in the Defense Department, most of them former business executives, are strangely indifferent to this problem or its implications for future defense strength.

## Burning Issues

In contrast the Congress has recorded a remarkable record during the session now drawing to a close. Capitol Hill is handling the burning issues of space technology, manue and advanced aircraft development and the sticky problems of air traffic control and air safety regulation. We cannot recall another session of Congress that has taken so much positive action on these crucial problems.

Perhaps the most important achievement in this field was the creation of the National Aeronautics and Space Agency using the technicians and laboratories of the National Advisory Committee for Aeronautics as its backbone. In the relatively short time of five months the House and Senate, with a free press spirit, tackled the national space agency proposals submitted by President Eisenhower and have forged an enthusiastic couple of essential, a unified national program in this vital area. We have been particularly impressed by the manner in which the special House Committee, headed by Majority Leader John McConnaughey of Massachusetts set the aid of a good professional staff, guided this program through what might have been a legislative morass and fought vigorously for the most effective compromise with a rather old Senate approach to the problem. Sufficient starting funds have been made available for the new

agency in the current fiscal year. If President Eisenhower will now make the key appointments of the director and the required new council members, the NASA can blast off toward a sustained, scientifically sound exploration of outer space.

### Vitally Needed Agency

The extraordinary election pique before Congress is the creation of an independent Federal Aviation agency with full authority to tackle the myriad problems of an traffic control and safety that have been so widely diagnosed as a bureaucratic mess. This action, pushed by Senator Mike Mansfield in the upper House and full-throatedly endorsed by Edward "Pete" Quayle on the executive side of the government, is now being its final hurdle in the House. We hope that Rep. Owen Harris, like man at the House for this bill, will provide some extraordinary, hostile to match the performance of Senator Mansfield and Mr. Quayle in ensuring the creation of the vitally needed agency in the next session of Congress.

In defense, Congress has also compiled a better than average record with a Defense Department appropriations bill that at least takes a positive step toward strengthening the Pentagon's knot of indecision. As usual Congress also has more sense than the executive branch in providing adequate funds for development of key weapons in advanced nuclear, aircraft and submarine programs. It has also begun to ring the bell on the vast bureaucratic expansion of the Military Air Transport Service into costly duplication of commercial airline services while neglecting the genuine problems of adequate military air bases.

Congress also became more aware of the tremendous complex relationship between the military services and the industrial complex that develops and produces new weapons. It should study five problems more thoroughly in the future. This area needs a complete overhaul of both its legislative and administrative aspects to develop a modern streamlined military industry reforming that protects the taxpayer/patient against excessive profits but at the same time permits industry to move with the speed its technical possibilities make possible.

—Robert Mates

## SAGE SETS AN ELECTRONIC "BEAR TRAP"

### BURROUGHS ELECTRONIC DATA PROCESSING EQUIPMENT STANDS WATCH FOR OUR CONTINENTAL AIR DEFENSE.

Problems of the awesome speeds and scope that confront our military defense systems can only be solved by the quick and accurate advantages of electronic computation, such as is found in our Semi-Automated Ground Environment—SAGE, which is now becoming operational! As a result Burroughs radar data

processing equipment fills important posts all along our peripheral continental approaches.

This major U. S. Air Force contract is one example of the widespread confidence in Burroughs Corporation's 70 year background of reliability and capability. It demonstrates Burroughs' new leadership in the development of electronic equipment and its continuing competence from research to final installation.



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## WHO'S WHERE

### In the Front Office

Amos N. Starobin, head chairman, Van Alstyne Co., Inc., Glendale, Tex.; Robert L. Jordan, executive vice president, Hughes Aircraft Co., Torrance, Calif.; George F. Brown and Vice Adm. James H. Doyle (USN, ret.), vice presidents.

Ralph S. Williams, director, Fairchild Engine & Airplane Corp., Hagerstown, Md.; John A. Kohnke, a director, Verbal Aircraft Corp., Monterey, Pa.

Ed. Gus. Rogers M. Boney (JRFV, ret.), a corporate vice president, Northrop Aircraft Inc., Beverly Hills, Calif.; Raymond Perry, president-director general, French model from S.E.P.R., successor of Groupes Glean, resigned.

Richard M. Adams, president, Kitchell Aircraft Products Co., subsidiary of New Britain Machine Co., Dayton, Ohio; Nathan H. Wall, president, Telsa Math. Co., Inc., Bridgeport, Pa.

The Rano-Woodbridge Corp., Los Angeles, Calif., has announced new resignations for the following: Dr. Ralph F. Johnson, group vice president of the Electronic Group of Division, Dr. Benton F. Miller, vice president and director advanced systems planning; Milton E. Mohr, vice president engineering; Erwin A. Boudet, vice president manufacturing for Deere and Los Angeles Division.

### Honors and Elections

Dr. Jerome C. Blumstein, Professor Emeritus of Massachusetts Institute of Technology, has been presented the Navy Distinguished Public Service Award, the highest award conferred in recognition by the Department of the Navy in recognition of his outstanding contribution in the fields of scientific research and development.

George F. Sullivan, manager of the Air Force Design Section at Randolf Air Force Station of North American Aviation Inc., has been named next year's Hamilton Professor of Aeronautical Engineering at the Massachusetts Institute of Technology. Mr. Sullivan, the first man from industry to be selected for the professorship, will conduct a course on rocket engine propulsion and also will do research on the design and development of rocket engines.

### Changes

Stephen R. Higgins, sales manager, Niagara Frontier Division, Bell Aircraft Corp., Buffalo, N. Y.

Carroll (Don) Diego, Calif.'s division of General Dynamics Corp., has announced the following appointments: A. P. Higgins, assistant vice president manufacturing affairs; J. H. Fawcett, works manager; Earl Tice, W. W. Fox, contract chief engineer; W. E. Kelly, in the general office, military vehicles staff.

H. R. Gifford, Jr., general manager of a new company, component but not defined, Industrial Electronics Division, General Electric Co., Florence, Ariz.; G. C. Lusher, secretary Mr. Gifford in general manager of the Division's Computer Department.

## INDUSTRY OBSERVER

► Nuclear reactors carrying personnel probably would be fatal to 50,000 or 60,000 by the atomic explosion because reactors were trained on in order to avoid the problem both on ground and in vehicle, according to Atomic Energy Commission thinking. At that altitude, there would be little scattering of radiation by the atmosphere, and shadow shielding can be used for crew compartments.

► Covert-Fort Worth is preparing a low-weight coolant auxiliary power supply to the Air Force for satellite and space vehicle applications in connection with Project SNAP (Secondary Nuclear Auxiliary Power).

► Pratt & Whitney J57 engine which powers North American's G4M-77 Harrier Dog could be the Boeing B 53D in a pod suspended below the aircraft's fuselage. B57 does not carry afterburners. F105 from which missile is being carried monitoring and locating equipment.

► Jet-engine pitch and roll controls on F-105 first ballistic missile are boresights aimed into the rocket exhaust to achieve the efficiency of one or more of the four nozzles (AW July 34, p. 22). Thrust deflection control occurs the correct amount. Variation in total thrust due to jet-engine action can be compensated by varying force to thrust termination.

► V-engine engines used on the Atlas intermediate-range ballistic missile for roll action and precision thrust adjustment in the main engines are Propellant engine uses liquid oxygen and RP-1, a kerosene-like liquid to rocket fuels which burns at temperatures above 5,000°F.

► Soviet air force ground crews are assuming intensive training in decontamination techniques aimed at getting fighters and bombers into the air at the earliest possible moment after nuclear bomb attacks on Russian airfields. Special machines and materials reportedly have been developed for quick decontamination of landing areas and runways. Flight crews wear bulky protective clothing while entering radioactive zones of the airfield to reach their decontaminated aircraft.

► Pre-cooling tests at Wright Air Development Center test chamber have shown that a person whose body temperature has been reduced by only two degrees can withstand temperatures of 150°F for 40 min longer than if he had entered the test chamber with normal body temperature.

► Defense Department's Advanced Research Projects Agency already has programmed approximately 30 separate space projects involving a total of about \$70 million.

► George A. Fuller Co. has secured an \$11,762,610 contract for construction of an concrete launch pads and two concrete Machinists for Atlas intermediate-range ballistic missile site near Cheyenne, Wyo. Contract will be under production of U. S. Corps of Engineers Omaha.

► Boeing B-52 to be used as the mother ship for North American's X-15 high-altitude rocket research aircraft is now undergoing modification at Boeing's Seattle plant. Previously, plane had been at the Palmdale, Calif., facility of North American Aviation.

► Douglas Aircraft hopes to sell Air Force as a plan to use the DC-8 as a replacement for C-119A cargo aircraft as part of the overall plan to modernize the logistic fleet.

► Early Boeing and Douglas are working on cargo aircraft in the class of the new defunct Douglas C-112. Companies reportedly are working in both the rear and tailboom areas, with Douglas emphasizing the tailboom approach.

► Increased climb performance and greater thrust altitude of Boeing's B 53D has achieved by redesign of wing to incorporate integral air and slats, reduction of vertical stabilizer to 40 ft. 5 in. and use of Pratt & Whitney J57 P-43W engines.



## HOW THE SILICONES MAN HELPED...

### Build a Gyro for Straight Shooting!

Accuracy that could hit a fly from a screaming roller coaster... is needed so that it can be used to deliver loads without impairing its operation. That's the "impossible" fine control job built by Minneapolis Honeywell, Aeronautical Division. Known as the HIG-5 (Honeywell Integrating Gyro), lightweight and small enough to hold in the palm of your hand, it supplies the "sense of balance" necessary in sophisticated systems.

Operating in a vacuum fluid under wide limits of temperature and pressure, seals can be no less than perfect. What material was used? "O" rings of UNION CARBIDE Silicone Rubber.

Fabricated by Mooney Products Company, Racine, Wisconsin, these "O" rings were tested from -45 to +260 deg. F., at simulated pressures from ground level to operational altitudes.

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Under such rigid tests, UNION CARBIDE Silicone Rubber showed outstanding sealing qualities and resistance to compression set.

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## Washington Roundup

### Space Interest Log

SENATE APPROPRIATIONS COMMITTEE has criticized Air Force for "growing lack of energy in space activities." The committee, noted in its report that "while space is truly for the scientists and those with imagination, it may be the battlefield of tomorrow and the Air Force cannot afford to neglect this field." The committee also charged that USAF has allowed contractors to build their own duplicate test stands at government expense while government facilities "sit or rot." The committee wants a stipulation into the Fiscal 1974 defense budget limiting the use of defense funds for construction in order of priority needs testing facilities "and the fullest use is made" of government sites.

### Armed Forces 'Misutilization'

Rep. Albert W. Gendle (R-Conn.) also made a congressional inquiry into what he terms "misutilization of technical and scientific manpower in the armed forces."

Gendle in a floor speech said it has been estimated that the armed forces waste over 15,000 men in their technical and scientific ranks. He noted the men were either misassigned, completely unused or not used to the degree warranted by the formal scientific education and training they received as civilians. Added to this, he said, is the disproportionate amount of time the senior technicians use in required time to replace dates, including latching police, guard duty, minor guard, housekeeping and cleaning details, while he said dozens of other groups struggle to escape these details.

### FCC Compromise Offer

Airline and industry petitioners that Federal Communications Commission considers want action to shift to Doppler radar from 8,500 to 11,900 mhz (15W June 20, p. 21) were turned down last week, but the commission made compromise moves. FCC said it "anticipates" moving regular licenses, now at 11,900 mhz, to 8,500 mhz and Doppler until the date of the air port permit a shift to higher frequency. Agency also said it will "endeavor, to greatest extent possible, to provide reasonable accommodations for the 8,500 mhz Dopplers." First action reaction to FCC statement was enthusiastic, partially because of the many qualifications in its future possible action. FCC also set aside 11,900 to 13,400 mhz band recently rejected by government, for both civil government Doppler use.

### Airport Aid Need

Civil Aeronautics Administration's reluctance to back an extension of the Federal Airport Act was cited by Sen. Frank Lautenberg (N.J.) in a report on the Airport Operations Caucus last week. Lautenberg, who is the majority leader of the House Government Operations Committee, said of Director C. Thomas Borman and capital outlays required for airport improvements quality control services provided so that increased federal aid and the risk of increasing federal expenditures. Borman also told the subcommittee that airport facilities needed for jet transport should have been known at least three to five years ago. He advocated a system of more advanced planning between airport construction, users and air

port operators to prevent paralyzing shortfalls of airport facilities. Lack of sufficient funds to meet future requirements he said, "may well become the factor that holds the whole system."

### Space Committees

Although resolutions establishing standing committees on aeronautics and space have passed by both the House and Senate, chances are slim that members of either committee will be appointed during this session.

Least likely to take action is the House where all members as up to reelection. If the committee is appointed this session there is a chance some members would not return. The Senate could appoint its committee this session but not elect to wait because of the heavy workload between now and adjournment and the work involved in selecting the members. Meanwhile, the current select space committees of both Houses can carry on for the remainder of the year.

### Riddle Promise

Rickie Arden President George L. Gales has promised to Civil Aeronautics Board in Chicago to be considered to be company's shareholders along, but they take no action on his earlier request that they examine only with their members, representatives and members of the Board in Rickie's belief.

In response to a letter from Board Chairman James D. Dierker, Rickie said he would be the shareholders. Gales objected that "through an intermediary I may have extended beyond the point of reasonable discretion" and suggested for an "intermediate or representative" I may have affected on members of the Civil Aeronautics Board. Gales, who served Rickie in president in February, was charged by the Board with attempts to influence the action with a possible campaign.

### CAB Helicopter Ruling

Civil Aeronautics Board last week charged that one medical helicopter service would be considered developmental in nature and would require more representation until a larger helicopter that is "economically feasible" is made available. The Board announced its decision in ruling days a priority in Los Angeles Airlines for a stretch of its important certificate on a permanent basis.

### Unwanted Details

While, usually generally loaded Senate Appropriations Committee action in considering \$45 million of the Military Air Transport Service budget for procurement of aircraft and helicopters, the scheduled items would permit that detailed responses were not needed.

Under the Defense Department appropriations bill as reported by the committee, \$44 million was made available to MATS for its procurement of aircraft and transportation. Of this amount, \$21 million must be spent with U. S. assets that qualify in small business enterprises. This includes part of the independent authority. Purpose of the \$21 million class is to ensure a share of the business for the smaller firms.

—Washington Staff



single economies, is leading inevitably to peace and more order—defence.”

Regulation Board and Defense Department strongly urged continuation of recognition at the House level.

• **Thomas Coughlin**, the board's chairman, declared that "recognition has been not only to recognize excessive profits but to prevent them. It is common knowledge that the economic value of the recognition authority frequently induces contractors to price more closely than they otherwise would, and thus avoid excessive economic profits. The resultant dollar savings is the government's net benefit." He reported total savings through recognition over 1971 of over \$1.7 billion, as over \$100 million after corrected losses. Profits for the cost-price have been paid for only 12.5% of the \$202 deliveries of economic profits made by the board, he said.

• **Robert Doherty**, defense counsel, testified that present conditions of new weapon developments and high defense expenditures "exacerbate the economic crisis of recognition." He said, "While Defense Department has provided its continuing personal wish

considerable means of dealing with cost overruns, even in cases of new and experimental products, there remains areas in which only recognition can be left effective to assure that the government gets what it needs for its defense without paying excessive profits." Because of rapid technological advances in the missile, missile and space field, Doherty maintained, "past production and cost experience is not necessarily transferrable for forecasting and for avoiding excessive profits."

#### Allen Objectives

Allen made three major objectives for recognition in relation to its management of cost reduction and technological progress:

- **Objective**, Defense Department has created a flexible and objective program to ensure that costs for new and research projects to the government in the near majority of cases where actual savings achieved are in the aggregate to exceed the costs contemplated. Allen noted that recognition was discontinued for a World War II situation when there were "cost overruns with inadequate impact."
- **Broadened need against the defense**

industry as a whole. "The Board has said in effect that defense industry margins, as a whole, are excessive," Allen protested. "It would be understandable if one company, in a particular year, had its earnings related to something like the U.S. manufacturing industry average." He said that the savings of defense manufacturers for the 1946-72 period were 5.2% in comparison with the overall manufacturing average of 13.1%.

• **Criticism too vague**. The seven verdicts led down in the recognition act for determining economic profits, Allen said, "are so vague that their application of narrow standards is so severe that the individual judgment of five men, who, unlike the contracting officer who negotiates defense contracts, can have little or no detailed first-hand knowledge of the work performed years ago."

The recognition act verdicts are "efficiency of contractors," "reasonable cost of costs and profits," "costs," "costs of cost material," "contribution to the defense effort," "character of business," and "other factors," and are "of great importance by the Recognition Board."

• **Research and development in advanced components and techniques, including:**

- **Propulsion systems**—development of special rocket motors using conventional propellants and high-energy rocket motors plus initial contract development of solid-propellant rocket motors.
- **Vehicle subsystems**—airframe power supplies, control communication displays, personnel equipment, guidance system, air weapons.
- **Instrumentation**—airframe scientific instruments, tracking systems, telemetry systems.
- **Vehicle-related**—airframe space platforms, propulsion and telemetry test vehicles.

• **Research facilities**—segmentation, including:

- **Adaptation of public domain research facilities for handling large liquidated rocket motors.**
- **Extension of instrumentation facilities.**
- **High-energy rocket research facilities.**
- **Guidance and control facilities.**

## NASA Space Proposals

Washington—One of the last functions of the new National Aeronautics and Space Council will be to prepare a study-report on space programs to President Nixon for his approval. An outline of a suggested program was prepared by the National Advisory Committee for Aeronautics and submitted to the House Space Committee by Dr. Hugh L. Dryden, NACA director. It proposes:

1. Unmanned space flights to acquire scientific data, including:

- **Vertical probes.**
- **Satellite to study space environment.**
- **Lunar probes.**
- **Planetary and interplanetary probes.**
- **Weather reconnaissance.**
- **Communication developments.**
- **Astronomical observations.**
- **Investigation of manned space flight, including:**
- **Small-scale reusable orbiters.**
- **Vertical flight and reusable vehicles.**
- **Manmade orbital and reusable vehicles.**
- **Supporting biological studies.**

2. Research and development in advanced components and techniques, including:

- **Propulsion systems**—development of special rocket motors using conventional propellants and high-energy rocket motors plus initial contract development of solid-propellant rocket motors.
- **Vehicle subsystems**—airframe power supplies, control communication displays, personnel equipment, guidance system, air weapons.
- **Instrumentation**—airframe scientific instruments, tracking systems, telemetry systems.
- **Vehicle-related**—airframe space platforms, propulsion and telemetry test vehicles.

3. Research facilities segmentations, including:

- **Adaptation of public domain research facilities for handling large liquidated rocket motors.**
- **Extension of instrumentation facilities.**
- **High-energy rocket research facilities.**
- **Guidance and control facilities.**

One of the most important questions facing the new agency is how much money will be appropriated for its operations during FY 1979 and how quickly congressional action can be completed on its requests.

To the report published by the House Committee on Aeronautics and Space Exploration, it was suggested that about \$300 million a year would be needed for the first two at these years. The President, however, asked Congress for \$125 million in new funds for new military space projects. In addition, \$137 million will be transferred from the Advanced Research Projects Agency. The latter funds were appropriated for civilian projects under the direction of that agency.

Approximately \$100 million more is needed for NACA will be transferred to NASA to carry out the present NACA program.

This will give the new space agency about \$143 million for the current fiscal year.

## Satellites Suggested For Blast Detection

Genesee—Each satellite properly in development has been suggested by Genesee for the scientific value of its own mission. It is one of three high speed rockets applicable to detection of high altitude bursts of nuclear weapons.

Often are nuclear detection, possibly by radio telescope, and detection by high speed rockets of nuclear bursts from space.

Problem of detection of high altitude bursts is one of two suggested as extremely difficult. Often it is extremely difficult to detect a nuclear burst from space. It is proposed to place a series of upper altitude bursts under international control for development of detection techniques, but assumed observers can be placed in orbit to detect nuclear bursts from space.

Four systems have been recommended through mutual agreement between Western and Soviet bloc agencies in the past. The systems include: lunar, earth orbit, earth orbit, and submarine position collection. Construction cost from detailed discussion of the fourth system with Western scientists, asking for scientific research success. The collection and Russian maintaining that monitoring demand at ground stations is adequate. Russian also has no planes will be permitted to fly over the Soviet Union or collect information until after mutual weapons tests.

However, the Western group believes adequate information could be obtained by flying only international satellites and not too disturbed by the Russian refusal.

## Space Technology

# NASA Organization Awaits New Action

By Ford Eastman

Washington—Presidential approval of legislation establishing a new National Aeronautics and Space Administration is only the beginning of the steps required before the agency can move into full-scale space exploration.

The President's signature on the National Space Act approved by Congress (AW 147 7) p. 18) creates the administration in 1970. The report will be which it can be organized and its ability to meet or surpass Space Act advances in space technology depend upon subsequent moves in both the White House and Congress.

In signing the bill, President Carter, however, commended Congress for its promptness in creating the organization and formal enactment of the legislation a "historic step" in equipping the United States for leadership in the space age.

He also praised the National Advisory Committee for Aeronautics which will form the nucleus of the new agency for its long established record in research and cooperation with the military services.

He said the combination of space cooperation responsibilities with the NACA's traditional scientific re-

search function is a natural evolution. With administration and the realization that steps either must be or be being taken before the agency can move forward effectively.

• **President must make his choice for administrator** and a departmental secretary and transfer it to the Senate for approval.

• **President must submit to Congress a proposed budget for NASA and request authority for construction of facilities and purchase of equipment necessary to begin the initial steps of space exploration.** If Congress fails to appropriate sufficient funds during the first fiscal year, the current statute the agency's program could be seriously curtailed for the next six months or more.

• **President must appoint one government member and three civilian members to the National Aeronautics and Space Council and submit the names to the Senate for confirmation.** He also must submit to the Senate for confirmation the names of defense agencies designated as such government members in the committee in the event of an unavoidable absence.

• **President must appoint a chairman of a Civilian Military Liaison Committee created under the act to receive**

coordination and cooperation between the administration and the military services.

• **After appointments have been confirmed by the Senate, the NASA administrator must announce to the President published in the Federal Register, the organization of the agency, its functions, and its personnel, and is prepared to discharge the duties and execute the powers conferred upon it.**

• **Along with organization of NASA, all facilities, staff and activities of the National Advisory Committee for Aeronautics must be transferred to the new agency.**

• **President must transfer facilities, personnel and activities of other federal agencies, including those of the Defense Department, which are concerned primarily with the explorative and powerful aspects of space and air services for the immediate operation of NASA.** The President must submit a full report on the nature and effect of all transfers made before Jan. 1 to both the House and Senate.

• **Transfer can be made without Congress first approving a report and having it as the condition of transfer.**

• **Space Council must meet to review the significant aeronautical and space activities of all agencies, develop a program for the agencies, designate and**

responsibility for direction of all activities and advise the President on the development of an overall space program.

The most urgent requirement from the standpoint of time and expediency is the selection and approval of an administrator of NASA. (Listed here are appointed and confirmed, organization and operation of the space agency will be a standard.)

Next often mentioned for the post is Dr. Hugh L. Dryden, director of the National Advisory Committee for Aeronautics which will form a nucleus of NASA.

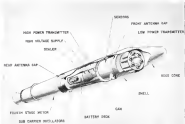
Cautiously, a large part of NACA's resources already are being used for space research and technology.

#### Goodwork Begun

Work of the groundwork necessary to form the new agency and preliminary preparations in launching the civilian space program have been completed by Dryden at the direction of the President.

The presidential directive called on NACA to:

- **Formulate detailed plans to construct**



ARMY Explorer IV satellite is 80 in. long and weighs 16-G lb. Instrument package contains four separate subsystem detectors. Satellite was launched by Jupiter-C (left).

## Space Technology

# Army Explorer IV Satellite

By Evert Clark

Washington—Army's Explorer IV, the first earth satellite designed specifically to investigate a problem discovered by earlier satellites, was launched successfully last week on the design and intensity of corpuscular radiation that must be considered in planning manned space flights.

Explorer IV was the first space vehicle launched and the first project completed under supervision of Defense Department's Basic Research and Development Research Projects Agency.

It also is the first U.S. satellite to cover all of the country and to pass over Soviet territory. Flared into an orbit inclined at 19.82 degrees north of the equator at 11:30 A.M. E.D.T., July 26, it passed over a point north of the city of St. Petersburg, approximately 100 miles and a half hour later. Its orbit also takes it over Russia's remote launching sites north of the Caspian Sea.

The satellite, weighing a head 7,000 lbs. wide around the earth, between 51 deg. north latitude and 51 deg. south latitude, compared to a head 4,700 lbs. wide to circle U.S. waters. The angle of inclination was a compromise between the desire to check radiation at the most extreme latitudes possible—was not with it believed to be greater than the price—and safety considerations of the Air Force Missile Test Center's range.

This angle probably is the greatest

at which any satellite can be fired safely from Cape Canaveral, Fla., without the risk of booster stages striking on land. Explorer I was launched at 33.5 deg., Explorer III at 51.77, and Vanguard I at 34.25 deg.—all inclined south of the equator. Polar orbits must swing farings along the Pacific Missile Range in California.

## New Solid Propellant

A new solid propellant developed by Army's Jet Propulsion Laboratory at Calicut, California, of technology was used in the third and fourth stages of the launching vehicle to compensate for the 7-11 lb. weight gain of Explorer IV over Explorer III.

Initial stages of the satellite was reported by Naval Research Laboratory as 1,373.1 lb. (actual weight was 161.9 lb.) and initial orbital period was 110.2 min. Four days after launching, weight was reported as 1,378.5 lb., period as 117.1 min., and orbital period as 118.224 min. Speed at apogee was 14,752 mph; at perigee, 18,400.

This apogee takes Explorer IV well into the radiation discovered by Explorers I and III, which began about 600 mi. above the earth. Until this launching sub environmental evidence supported the theory that the radiation could.

Geiger counters on the earlier Explorers were, pointed, apparently, by cosmic-ray intense, high energy radiation that was believed to be X-radiation



EXPLORER IV orbits 51 deg. in a 24 hr. period. Because satellite orbit was launched into an orbit inclined at 19.82 deg. north of the equator, orbital head exceeds 51 deg. north and 51 deg. south. Satellite orbits over the densely populated northern latitudes.

# Reports Corpuscular Radiation Intensity

counted when solar streams bombarded the satellite's skin.

Although intensity and range of the particles vary greatly, the radiation may increase with distance from the earth and may extend all the way to the sun. Count of about 1,000 in orbit is 51,000 particles per second.

Explorer IV's special apparatus for measuring the radiation is a Geiger counter with a diameter range that allows it to detect and count at 1,500 times the capacity of counters in earlier Explorers.

Counting Geiger counter. Covered with 1/8 in. of lead, this will measure absorption of X-radiation and count intensities of higher energy cosmic rays and may help determine the amount of shielding needed to protect passengers in spacecraft.

Two satellite's mission to measure total amount of cosmic rays from the radiation. Detectors are capable of cosmic rays; they are to be used to measure the amount of cosmic rays from the planet.

Explorer IV carries a 10 wattless transmitter using 108 mc. for the Army's Memphis radio monitoring network, and a 48 milliwatt transmitter using 168.05 mc. the Memphis frequency. Previous Memphis transmitter in Explorer I was only 60 milliwatt power. The new replaced in TV to gain a longer broadcast time. Mercury but power both transmitters and expected life for both is two months.

Total astronaut weight is 15.36 lb.

compared to 16.61 for the first Explorer and 10.83 for Explorer III. Instrument package was developed by graduate student George H. Ludwig and Carl E. Melburn of the Physics Department of the State University of Iowa, under the direction of Dr. James A. Van Allen. Level of international cooperation was for the U.S. International Geophysical Year Committee's Technical Panel for the Earth Satellite Program.

By Van Allen had reported the newly discovered radiation last Mar. 1, following the Mar. 20 launching of Explorer III.

Data obtained from Explorer IV probably will be reduced more quickly than with earlier satellites, since temperature and ionospheric data does not have to be separated out. Results will be supplied to all countries participating in the IGY, including the Soviet Union.

Explorer IV gains the benefit of a greater number of solar and optical tracking stations than any earlier U.S. satellite. Since last Feb. 5, of 12 Baffin Island stations is the optical tracking network established by the Smithsonian Astrophysical Observatory, has a been in action. Meanwhile stations in the U.S. are number 10. They are located at Cape Canaveral, Fla., Ft. Monmouth, N.J., Rochester, Ariz., Van Horn, N.M., Aberdeen Proving Ground, Md., White Sands, N.M., Cedar Rapids, Iowa, and Temple City, China Lake and Culberson Test Station, Calif.

This report to an evaluation center at Army's Ballistic Missile Agency.

ARMY again funded satellite and launching of Explorer IV. The modified Jupiter-C used as a launching vehicle amounted of a modified Cluster. Red more made in a first stage, 11 solid-state Sigmagat solid rocket in the second stage, three solid rockets in a third stage, and a single solid rocket for the fourth stage, which is a part of the launching vehicle itself.

Only third and fourth stages contained the new propellant developed by JPL, details of which Army and JPL declined to discuss.

## External Configuration

Externally, the satellite vehicle is roughly like the third Explorer—bullet-shaped, 80 in. long and 6 in. in diameter, consisting of a 40-in. meter that weighs 12.67 lb., after launch, and the 21.95 lb. satellite. Explorer IV was two double antenna which are part of the satellite skin, as did Explorer III. Explorer IV carries antenna with four whip elements was bleated for performance which approximately equals the single tone to be provided between the satellite and the ground station.

Earlier satellites still in orbit are Explorer I, launched last Jan. 30, Van Horn 2, a 6-4 in. ball shape launched last Mar. 17, and Russia's Sputnik I, launched last Mar. 18. Sputnik I and II and Explorer III have disintegrated, and Explorer II did not go into orbit.

ARMY Jupiter-C that put Explorer IV in orbit is launched from Cape Canaveral.



## Dassault Mirage Enters German Fighter Picture in License Deal

Gene-French Hel, one of Germany's most advanced military aircraft, has signed an agreement with Dassault to produce the Mirage IIIA under license.

Flück's personal assistant denied reports of a connection between the agreement and Dassault, and producers of French airplanes in Germany had observed until similar details when Flück was reported moving to Düsseldorf, Germany, and a German newspaper.

In Paris, a Dassault spokesman refused comment on the company's talks with Flück, saying the agreement is "at least one year old." A source close to the management at Saab Aircraft of Germany, which sold the aircraft, was long discredited since, true as it had not been whether the agreement had been reached, Flück has a major interest in Saab.

Two technicians at Messerschmitt are believed to be working on the deal but complained that if such an agreement were reached, Messerschmitt would certainly be chosen to participate. Flück's recent report on the agreement with Dassault AC, engineers and plastics producer.

### Price Details

Final agreement is said to have been reached in mid-March. Shortly thereafter, Flück is understood to have written a memorandum and detailed recommendations to the Defense Ministry regarding manufacturing and price details.

Price of the airplane for an order of 280-300 is said to be between \$600,000 and \$675,000 apiece. Dassault would retain licensing German engineers and technicians in 1976 and would also supply the engine sub-assemblies. First three pre-production models would be turned over by Flück to German Research Center later in March 1976.

Initial production would be at the rate of one per month, rising to 13 by 1978.

It would target down to the first pre-production completion of the order in September or October 1976.

It is believed that Dassault could receive 15% of the sales price for its licensing. French firms' desire to be up with Flück rather than Thuringen, Bonn, Germany, producers of the Messerschmitt and Heinkel, is understood to be based primarily on economic factors.

Dassault has been marketing some French aircraft since the war.

Blended with Messerschmitt is a potential to use capital in its own. Flück, on the other hand, is said to be one of the three wealthiest men in Germany and has extensive holdings in non-metal, automotive, metal, oil, finance, machine-building and cement. A leading membership organization in World War II, he is connected with several parts of a business as a copier of state labor and better of German companies. During 1958 Flück, who has been in Germany since 1948, is said to be in contact with a group that is not as connected as Flück's other groups. Long the symbol for industrial power.

### Subcontracting Factors

German Defense Ministry officials would want that some companies for the Mirage be turned out to be flying. These would be: The aircraft group, which includes the engine and the engine, has had its business most closely to the American firms in the production of a division in favor of Lockheed in Germany's F-105F Super Tiger.

Saab Aircraft would rather confirm its own that it would be major contractor for the Mirage IIIA should the Defense Ministry select the French fighter.

A Defense Ministry spokesman would say that the decision between the Lockheed F-104 and the Mirage IIIA has been reached. Defense Ministry from Flück's work in his last statement on the subject, said a decision.

### TAC Strike Force

Recent-Dassault AC, a German company, is said to be working on the Air Force in Turkey. There are U.S. Mirage IIIA in German use. This includes the following types of aircraft:

- North American F-100D fighter
- Lockheed F-104F, F-105F, F-106F, F-107F, F-108F, F-109F, F-110F, F-111F, F-112F, F-113F, F-114F, F-115F, F-116F, F-117F, F-118F, F-119F, F-120F, F-121F, F-122F, F-123F, F-124F, F-125F, F-126F, F-127F, F-128F, F-129F, F-130F, F-131F, F-132F, F-133F, F-134F, F-135F, F-136F, F-137F, F-138F, F-139F, F-140F, F-141F, F-142F, F-143F, F-144F, F-145F, F-146F, F-147F, F-148F, F-149F, F-150F, F-151F, F-152F, F-153F, F-154F, F-155F, F-156F, F-157F, F-158F, F-159F, F-160F, F-161F, F-162F, F-163F, F-164F, F-165F, F-166F, F-167F, F-168F, F-169F, F-170F, F-171F, F-172F, F-173F, F-174F, F-175F, F-176F, F-177F, F-178F, F-179F, F-180F, F-181F, F-182F, F-183F, F-184F, F-185F, F-186F, F-187F, F-188F, F-189F, F-190F, F-191F, F-192F, F-193F, F-194F, F-195F, F-196F, F-197F, F-198F, F-199F, F-200F, F-201F, F-202F, F-203F, F-204F, F-205F, F-206F, F-207F, F-208F, F-209F, F-210F, F-211F, F-212F, F-213F, F-214F, F-215F, F-216F, F-217F, F-218F, F-219F, F-220F, F-221F, F-222F, F-223F, F-224F, F-225F, F-226F, F-227F, F-228F, F-229F, F-230F, F-231F, F-232F, F-233F, F-234F, F-235F, F-236F, F-237F, F-238F, F-239F, F-240F, F-241F, F-242F, F-243F, F-244F, F-245F, F-246F, F-247F, F-248F, F-249F, F-250F, F-251F, F-252F, F-253F, F-254F, F-255F, F-256F, F-257F, F-258F, F-259F, F-260F, F-261F, F-262F, F-263F, F-264F, F-265F, F-266F, F-267F, F-268F, F-269F, F-270F, F-271F, F-272F, F-273F, F-274F, F-275F, F-276F, F-277F, F-278F, F-279F, F-280F, F-281F, F-282F, F-283F, F-284F, F-285F, F-286F, F-287F, F-288F, F-289F, F-290F, F-291F, F-292F, F-293F, F-294F, F-295F, F-296F, F-297F, F-298F, F-299F, F-300F, F-301F, F-302F, F-303F, F-304F, F-305F, F-306F, F-307F, F-308F, F-309F, F-310F, F-311F, F-312F, F-313F, F-314F, F-315F, F-316F, F-317F, F-318F, F-319F, F-320F, F-321F, F-322F, F-323F, F-324F, F-325F, F-326F, F-327F, F-328F, F-329F, F-330F, F-331F, F-332F, F-333F, F-334F, F-335F, F-336F, F-337F, F-338F, F-339F, F-340F, F-341F, F-342F, F-343F, F-344F, F-345F, F-346F, F-347F, F-348F, F-349F, F-350F, F-351F, 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F-1090F, F-1091F, F-1092F, F-1093F, F-1094F, F-1095F, F-1096F, F-1097F, F-1098F, F-1099F, F-1100F, F-1101F, F-1102F, F-1103F, F-1104F, F-1105F, F-1106F, F-1107F, F-1108F, F-1109F, F-1110F, F-1111F, F-1112F, F-1113F, F-1114F, F-1115F, F-1116F, F-1117F, F-1118F, F-1119F, F-1120F, F-1121F, F-1122F, F-1123F, F-1124F, F-1125F, F-1126F, F-1127F, F-1128F, F-1129F, F-1130F, F-1131F, F-1132F, F-1133F, F-1134F, F-1135F, F-1136F, F-1137F, F-1138F, F-1139F, F-1140F, F-1141F, F-1142F, F-1143F, F-1144F, F-1145F, F-1146F, F-1147F, F-1148F, F-1149F, F-1150F, F-1151F, F-1152F, F-1153F, F-1154F, F-1155F, F-1156F, F-1157F, F-1158F, F-1159F, F-1160F, F-1161F, F-1162F, F-1163F, F-1164F, F-1165F, F-1166F, F-1167F, F-1168F, F-1169F, F-1170F, F-1171F, F-1172F, F-1173F, F-1174F, F-1175F, F-1176F, F-1177F, F-1178F, F-1179F, F-1180F, F-1181F, F-1182F, F-1183F, F-1184F, F-1185F, F-1186F, F-1187F, F-1188F, F-1189F, F-1190F, F-1191F, F-1192F, F-1193F, F-1194F, F-1195F, F-1196F, F-1197F, F-1198F, F-1199F, F-1200F, F-1201F, F-1202F, F-1203F, F-1204F, F-1205F, F-1206F, F-1207F, F-1208F, F-1209F, F-1210F, F-1211F, F-1212F, F-1213F, F-1214F, F-1215F, F-1216F, F-1217F, F-1218F, F-1219F, F-1220F, F-1221F, F-1222F, F-1223F, F-1224F, F-1225F, F-1226F, F-1227F, F-1228F, F-1229F, F-1230F, F-1231F, F-1232F, F-1233F, F-1234F, F-1235F, F-1236F, F-1237F, F-1238F, F-1239F, F-1240F, F-1241F, F-1242F, F-1243F, F-1244F, F-1245F, F-1246F, F-1247F, F-1248F, F-1249F, F-1250F, F-1251F, F-1252F, F-1253F, F-1254F, F-1255F, F-1256F, F-1257F, F-1258F, F-1259F, F-1260F, F-1261F, F-1262F, F-1263F, F-1264F, F-1265F, F-1266F, F-1267F, F-1268F, F-1269F, F-1270F, F-1271F, F-1272F, F-1273F, F-1274F, F-1275F, F-1276F, F-1277F, F-1278F, F-1279F, F-1280F, F-1281F, F-1282F, F-1283F, F-1284F, F-1285F, F-1286F, F-1287F, F-1288F, F-1289F, F-1290F, F-1291F, F-1292F, F-1293F, F-1294F, F-1295F, F-1296F, F-1297F, F-1298F, F-1299F, F-1300F, F-1301F, F-1302F, F-1303F, F-1304F, F-1305F, F-1306F, F-1307F, F-1308F, F-1309F, F-1310F, F-1311F, F-1312F, F-1313F, F-1314F, F-1315F, F-1316F, F-1317F, F-1318F, F-1319F, F-1320F, F-1321F, F-1322F, F-1323F, F-1324F, F-1325F, F-1326F, F-1327F, F-1328F, F-1329F, F-1330F, F-1331F, F-1332F, F-1333F, F-1334F, F-1335F, F-1336F, F-1337F, F-1338F, F-1339F, F-1340F, F-1341F, F-1342F, F-1343F, F-1344F, F-1345F, F-1346F, F-1347F, F-1348F, F-1349F, F-1350F, F-1351F, F-1352F, F-1353F, F-1354F, F-1355F, F-1356F, F-1357F, F-1358F, F-1359F, F-1360F, F-1361F, F-1362F, F-1363F, F-1364F, F-1365F, F-1366F, F-1367F, F-1368F, F-1369F, F-1370F, F-1371F, F-1372F, F-1373F, F-1374F, F-1375F, F-1376F, F-1377F, F-1378F, F-1379F, F-1380F, F-1381F, F-1382F, F-1383F, F-1384F, F-1385F, F-1386F, F-1387F, F-1388F, F-1389F, F-1390F, F-1391F, F-1392F, F-1393F, F-1394F, F-1395F, F-1396F, F-1397F, F-1398F, F-1399F, F-1400F, F-1401F, F-1402F, F-1403F, F-1404F, F-1405F, F-1406F, F-1407F, F-1408F, F-1409F, F-1410F, F-1411F, F-1412F, F-1413F, F-1414F, F-1415F, F-1416F, F-1417F, F-1418F, F-1419F, F-1420F, F-1421F, F-1422F, 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replicative explosion vehicles and studies relating to laser explosion.

Poole said the program also will "conduct studies designed to extend the capabilities of the F-101 fighter bomber," which Republic is building for the Air Force. In the aircraft field, Poole added the company has "an inventory" of developing technology under way by other firms, but will concentrate on development of new concepts in space-to-surface, surface-to-surface, air-to-surface and long-range surface-to-surface.

The company, he said, already has

## Kincheloe Crash Raises Control Question as USAF Probe Continues

Edwards AFB—Actual cause of the accident which resulted in the death of a young man, Kincheloe here announced officially underscored last week as USAF investigation probed aerospace.

Kincheloe, who was to be USAF pilot on the North American X-15, was killed when the probe was falling in a steep climb after a low-level operation from an F-104 shortly after take-off on a support flight job.

Information so far indicates there was no complete loss of power in a five-second period power losses, as reported in report that Kincheloe apparently was critical in announcing he

was losing the aircraft.

Expert opinion has it that Kincheloe pulled the aircraft to the control altitude for optimum due to low low altitude, indicating also that some degree of lateral control was still available. Expert opinion also is that Kincheloe was less than 1,000 ft above ground when the trouble started, although his highest point was unknown.

Landing was reliable information as to the explosion's origin toward the ground as it passed. One crewman told investigators the plane appeared to be going 300 mph and looked like it was landing. The viewing position was almost head-on and he did not see the aircraft before it descended the plane's course as from south to southeast which, as consequence with impact point, indicated Kincheloe was headed west from Rosamond Dry Lake.

Efforts to show up all parts of the flight in relation to geographic position and what was happening, still have a blank spot of approximately 70 sec which is indicated to have been after Kincheloe fell and before impact. It would have been during this blank time that critical point in flight was passed.

Accident brought into sharp focus the question of subsonic controls for variable stability and inlet guide vane of F-104's J79 turbojet engine (AWE Feb 10, p. 10). Reports are that pilots have urged substitution of manual for the automatic controls for the inlet guide vanes and AWE says that these are a possibility of the aircraft being grounded until USAF investigation resolved the question of whether this was test of the position and manual controls are the proper fix.

AWE says it has learned that a proposal has been made and is now being studied, for recognition of a cockpit/limited, pilot-actuated manual override switch for the variable geometry inlet controls.

### Soviet Space Study

Moscow—Russia is around the strong vehicles that would use the circumferential fields or space as an energy source for propulsion. G. I. Fokanov, member of the Soviet space flight commission, said in the Soviet journal "Tekhnika i Nauka" that the portable nuclear reactor is necessary to achieve the energy in these fields runs through and in the specific form that would be needed by a space vehicle.

Fokanov says two design would be used—one to accelerate positive particles and the other negative particles. He explains that, if the vehicle was in a cosmic electron field with the positive nucleus turned on, the ship would generate toward the negative side of the field. Direction of motion would be controlled by changing the shape on the ship.

Concerning the relation between the energy required to operate the reactor and the energy available in the magnetic field in space, Fokanov says "the energy to start the ship may be obtained from explosives or from a small supply of fuel. The energy of the field will be considerable in comparison with the energy later to come negative fields which can be used to drive a ship."

New being phased into production aircraft is a prepositioned outside activity for the variable geometry inlet mode.

These variable geometry features are among the design innovations in the F79 which contribute to the engine's performance, with the subsonic engine when working in excellent. Use of pilot controls for emergencies are expected to contribute naturally to clearing up problems.

### Senate Group Boosts Defense Budget

Washington—Senate last week voted Department of Defense \$12 billion more than it asked for in its fiscal 1979 budget. The appropriation was accompanied by an amendment from the Senate Appropriations Committee to cut military construction costs.

Disputing a report on steps taken to achieve this by Sept. 15, the committee said that it is "generally concerned over the stability of the Department of Defense to provide a decision on a continuing basis of contracts with private industry." It added:

"It is recognized that in a period of generally rising prices, increased costs are inevitable. However, there is no adequate substantiation for the belief that there is little incentive to produce

RESEARCH, A. N. ICE CANADA LIMITED & THE HAWKES BATTERY GROUP



IROQUOIS development engines have completed over 5,000 hours of bench running in these test cells at Malton and in flight tests.

Over 100 hours were accumulated during a recent series of test runs at the NACA Lewis Flight Propulsion Laboratory, Cleveland, Ohio.

Further tests will be conducted in Orenda's new high altitude facility to investigate IROQUOIS performance over the widest range of speed and altitude.

IROQUOIS test results at NACA Lewis Flight Propulsion Laboratory, Cleveland, U.S.A.

1. Predictable highest dry thrust recorded in North America for turbine
2. Successful operation under constant high inlet temperature
3. Thrust up to 10,000 lb., the limit of the turbine, proved effectiveness of Orenda patented method
4. Altitude handling improvements indicated by test results
5. Thrust/weight 5.1
6. Thrust-to the 10,000 lb. class (highest efficiency)



## BENDIX\* IGNITION SYSTEMS—FOR THE BEST IN JETS

General Electric's J79 jet engine—an engine capable of powering aircraft at twice the speed of sound—incorporates an ignition system designed and manufactured by Scintilla Division, of Bendix Aviation Corporation. Years of engine design experience have made Scintilla Division a primary source for reliable ignition systems used in the newest and finest military aircraft.

The J79 is General Electric's answer to the need for a high-thrust, low-weight, jet engine for today's and tomorrow's high performance aircraft. Due to its out-

standing thrust-to-weight ratio, this engine has a wide range of applications, including guided missiles, bombers, fighters and commercial aircraft. In addition to its high performance capabilities, the J79 features translation flexibility, maintenance simplicity and uses a minimum of critical material.

Scintilla's reliability and extended overhaul life are inherent features of Bendix-designed jet engine ignition systems.

Circle 40 for more facts, 120 Scintilla Division, Bendix Aviation Corporation, Bendix Division

**Scintilla Division**  
Bendix, NEW YORK



industry to hold down spending defense contracts. Automatic increases to labor demands are made by industry, knowing that those increases will not require absorption but will be passed on to the government.

The putting of technical employees and skilled work men has been much publicized, the cost of which, actually, is absorbed in government contracts. The general level of a pricing award for nonmilitary products, once competitive marketing is removed, is minimal to the public interest, and workers are defense assets.

The Senate committee's report would bring the Fiscal 1979 defense budget to over \$10 billion—\$5.5 billion over the Fiscal 1978 budget.

Fiscal increases made to the Department's request included:

- \$166.7 million for 15 B-52G bombers
- \$111.2 million for 50 KC-135 tankers

- \$140 million for strategic airlift aircraft

- \$90 million for Minuteman missile program, ballistic missile development and \$75 million for procurement.

- \$86 million for Hummer Dog air-to-ground missile to equip B-52 forces

- \$709 million for Navy's Polaris fleet ballistic missile program. This represents \$601 million for fleet submarines, \$71 million for research and development.

### First DC-8 Logs 45 Flight Hours

More than 45 hr of flight time has been logged on the first production model of the Douglas DC-8 in the two months since the first flight May 10. This compares with 574 hr on the DC-7 and 49 hr on the DC-7C during the first two months tests.

R. L. Holzman, director of Douglas' testing division, said that tests completed to date are most satisfactory. Total flight time of 45 hr, 10 min through July 29 was divided into 17 flights, much of increasing duration. Flights 11 and 13 each lasted 54 hr in duration. Minimum altitude was 6,000 ft, 10 hr, 50 min, stepped at 500 ft or more down 150 mph, altitude 16,000 ft. The DC-8 has carried a full load and has taken off at a gross weight of 215,000 lb.

### Vertol 44 Aids In Oil Search

New Orleans—A single amphibious Vertol V-44 helicopter, pioneering new techniques of oil search and exploration on the rugged coastlands of the Gulf region at the Mississippi River's

### Research Pool

General Motors' experience in the oil and natural gas industry has been entered into a working agreement to jointly develop advanced devices for guided missiles and space land.

The three-way agreement calls for a pooling of resources for missile and space work but does not require that the work be done on either a prime or subprime basis. It is not intended to assist the individual research, sales or production programs of the separate companies.

When the contract does seek contracts as a unit, the research and development facilities, personnel and mass production capability of the three firms will be offered in the most advantageous combination for the job at hand.

General Motors' experience in the guided missile and space field centers is primarily focused on burning engines, guidance systems, missile components and structures. Gilley produces propellers and landing gear. Thiokol has wide background in solid fuel rockets and though in recent acquisition, Research Motors, a liquid fuel rocket capability.

craft, may provide the petroleum industry with the technology it is looking to economically produce true technical resources, at the same time spark a vital new market for rocket engine aircraft to match the record set in the offshore energy sector.

Experiment is being watched particularly by Vertol who has been seeking hard to crack the oil industry market now heavily served by Sikorsky and Bell. Mid East area is certain to open oil and gas exploration activities in less vulnerable area, as it did at time of Iraq crisis a year ago. A source close to the international petroleum industry told Associated Press. New group started June late last month on a 30-day test base for Pan American Oil Co. involves charter of V-44 under contract from Indar Inc. a New York-based helicopter operator devoted to provide rotary wing lift for the petroleum industry, as a prototype, being supplying helicopters, crews and maintenance. V-44 is being flown in Vertol Aerosol Corp. pilot Al Temple, based to Indar for the project.

Current operation involves search of heavy-duty, rotary-type petroleum exploration equipment and technicians into marshland areas as well as most cases that terrain cannot even suggest a man's weight. Goal is to use the large tandem rotor cargo type V-44 with its practical in replacing slow, cumbersome marsh buggies and boats, which have been the main means of working

the area. In an effort to slash costs of slow and inefficient surface transport, Vertol B-57 helicopters, knee high, tread, and found wanting, according to an on-the-scene observer. Their primary disadvantage: small payload has necessitated use of lightweight "Mickey Mouse" search gear, mainly a compass and one of two small skis for the job.

Indar's V-44, operating from a barge, has been outfitting a barge 1,600 ft, measuring existing assets and their structural equipment and cable, also 1,200-ft, 500-lb onshore drill rigs being under its handling on the barge deck.

Equipment is mounted on platforms moving slowly, open for helicopters, these assets are fitted with Bell's copier rubber foot gear to sustain them on soft ground as water, enabling them to be located precisely where they are needed.

When vehicles do not permit exact placement of equipment, it can be lowered to surface in a state where while area toward spot desired, also, if vehicles nearby in cluster, too, can the be used. V-44 has shown good towing capability, the twin rotor configuration leading itself to pulling equipment across even rougher tops of surface.

### News Digest

**Rocketdyne Division of North American Aviation, Inc.**, has received a USAF contract to develop a 1 million lb. thrust liquid propelled engine. In its final stage the engine will produce approximately 1.5 million lb. thrust.

Two Navy balloons last week successfully flight tested a novel, solar-cell powered radio system that will be used with a 16-in. telescope next November for spectrographic studies of the atmosphere of Mars.

Canadair Ltd. is negotiating with Bell for sale of about 160 of the company's Canadair 580 turboprop aircraft. Deal is contingent on Canadair building and operating a production plant at Bell. Sale contract would be worth about \$100,000.

Wells Fargo, American Airlines (see p. 10), has been named to lead the company's public relations department. The success of W. D. Smith, who has held the position since 1945 and retired.

Final services for Lt. Gen. Clarence L. Chappelle, USAF, ret., were held last week at Arlington National Cemetery near Washington following his death of lung cancer at New Orleans.

# AIR TRANSPORT



American Airlines Boeing 707 transports show two side-by-side engines behind induced engines, raising cruise speed to 655 mph.

## American Orders Area-Ruled Jetliners

By Glenn Carnan

New York—American Airlines has placed orders for two types of modern range jet transporters—one of them a revolutionary new design—and has entered into a unique lease arrangement with three engine manufacturers for 900 gas turbine engines.

As predicted in *Aviation Week*, July 21, p. 31, the carrier is buying General Model 600 jet transporters.

area rule and equipped with General Electric turbofan engines. In addition to 25 of the 600s for 1965, 62 deliveries, American has ordered 25 intermediate-range Boeing 707-123s with full deliveries expected in the first half of 1966. The airlines' regional order of 19 long-range Boeing 707-123s has been cut to 17 with the new round of medium jet delivery. Options have been taken on an additional 25 Boeing 707-123s and 25 Boeing 707-420s.

The leasing arrangements with Pratt & Whitney, General Electric and Allison Division of General Motors encompass seven JT3 engines for the Boeing 707-123, CFM56-2 engines for the General and Allison 501-D engines for the Lockheed Electra transport. A total of some 645 engines are involved in the lease and would not amount to about 550 million. American President C. R. Smith and the airline will see about 550 million in capital expenditure through the lease plan in solving lower quart engines and parts and a later purchase.

Alison's lease will run for a five-year period from the date of the flight to carry new revenue service. The other two leases will extend for seven-year periods from start of service.

Smith said the Pratt & Whitney engines were priced at about \$155,000 each, the General Electric transports at \$208,000, and the Allison at \$209,500. But of the newly ordered medium jets cost about \$5.2 million without engines. Total cost of American's turbine aircraft under new trends at \$593 million. Smith said the airline's policy for financing after the last jet deliveries in 1962 would probably total about \$2 billion.

No additional financing was seen for the new jets because of the lease arrangement, Smith said. American has the option to buy the leased engines at their unamortized value at any time, but for less than 10% of the normal purchase price.

General Model 600 transport de-

signs represents a basic design change over the earlier Model 500 prototype was under construction at San Diego. Model 500 has been ordered by Trans World Airlines and Delta Air Lines. Main characteristics of the Model 500 design is a modification of the Boeing 707's NACA air duct which moved the transport's Mach number from 0.9 to 0.91 and a cruising speed of 575 mph compared with 565 mph for the Model 500. The Model 600 also has a larger wing area, longer fuselage, higher gross weight and bigger payload than the Model 500. With the 15,000 lb. Pratt General Electric turbofan engines and the new design, the Model 500 will improve about 1,000 lb. less weight for maximum gross weight than the Model 500.

The area rule application is visible in the two bays protruding from the trailing edge of each wing in each side of the induced engine pylon. The General Electric turbofan engine is now mounted on top instead of the fuselage. The plan of the Allison Gas Turbine Division. It will be equipped with a turbofan for the Model 600 modification.

American Airlines spokesman said the Pratt & Whitney Aircraft turbofan version of the 707 was about a year and a half behind the General Electric turbofan in its development but that Pratt & Whitney's turbofan would make an excellent engine for the Model 600 modification.

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observed the full load gross weight of the 707 had recently in Seattle and the aircraft would be used to test the Pratt & Whitney Aircraft turbofan version of the 707. The Pratt & Whitney Aircraft turbofan version of the 707 will be used to test the Pratt & Whitney Aircraft turbofan version of the 707. The Pratt & Whitney Aircraft turbofan version of the 707 will be used to test the Pratt & Whitney Aircraft turbofan version of the 707.

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## American, Allison Lease Plan Establishes New Financial Pattern

By L. L. Doty

Indefinite—Agreement between American Airlines and Allison Division of General Motors whereby the carrier will lease rather than buy the 162 turbofan engines needed to power its fleet of Lockheed Electra and a drastic change in traditional aircraft construction methods.

It marks the first time in history that a U.S. air carrier has had down plan to lease engine capital expenditures by leasing direct ownership of equipment. According to one manufacturer, the agreement could set a pattern that would give the airline industry the lift it needs in moving into the period of jet operations during the next phase of the boom and heavy capital commitment.

The Allison-American agreement, announced by American Airlines last spring (AVW May 12, p. 41), has not been formally signed, but both sides expect to sign a final contract by the end of the year. The agreement is expected to be completed within 30 days.

A final rental rate has not yet been fixed by the two companies. American will handle all insurance coverage and assume full responsibility of the engine part as though they owned them.

Under the engine overhaul arrangement, engines will be shipped by American to a reliable overhaul firm of each engine. According to the Civil Aeronautics Administration, no overhaul firm has been set up for the engine. It is at the present time undergoing certification tests.

\$15,000. This is less than the \$25,000 cost estimated last fall by Smith (AVW Nov. 5, p. 40). More detailed planning has provided enough information to revise the estimate.

Use of three different types of engine jet aircraft in addition to the Electra is not expected to cause problems with maintenance as more experience grows equipment. Smith said. The airline order was divided to take advantage of the different operating life of the aircraft types. The 707-123 will be in service over intermediate distance, as will the General 600. The Electra, however, will be capable of operating anywhere instantaneously.

American has been set at \$200 lb. per engine engine overhaul for its first 107-123 operations and increase that to \$300 lb. per Civil Aeronautics Administration, however, is presently holding out for \$600 lb. Smith reported.

### American Airlines Jet Specifications

	Boeing 707-123	Boeing 707-420	General 600	Lockheed Electra
Passengers	100-150*	90-130*	90-120*	65
Cargo				
Cruise	3,675 m.p.h.	3,190 m.p.h.	3,675 m.p.h.	3,615 m.p.h.
Speed				
Service	3,615 m.p.h.	3,015 m.p.h.	3,615 m.p.h.	3,475 m.p.h.
Engines	Four P&W JT3C-6 turbojets	Four P&W JT3C-7 turbojets	Four GE JT3C-6 turbojets	Four Allison 501-D turbojets
State takeoff thrust	15,000 lb. (wet)	12,000 lb. (wet)	15,000 lb.	3,750 lb.
Max. gross				
Takeoff weight	247,000 lb.	302,000 lb.	218,700 lb.	113,000 lb.
Full capacity	15,450 gal.	11,500 gal.	15,200 gal.	4,400 gal.
Between cities				
Wing	142 ft.	142 ft.	128 ft.	128 ft.
Length	144 ft.	118 ft.	118 ft.	104 ft.
Wingspan	110 ft.	110 ft.	110 ft.	99 ft.
Tail height				
(from ground)	16 ft.	15 ft.	17 ft.	15 ft.

\* Depending upon interior seating arrangements.

### American Airlines Jet Orders

Boeing 707-123*	Boeing 707-420*	Delivery Date
25 Boeing 707-123*	Pratt & Whitney JT3 turbojet**	1959-1961
25 Boeing 707-420*	Pratt & Whitney JT3 turbojet**	1960-1961
25 General 600	General Electric CFM56-2 turbofan**	1961-1962
25 Lockheed Electra	Allison 501-D turbojet**	1959-1960
* Based on engine commitment for 30 when order for medium range model was placed.		
** Engines to be leased by American from the manufacturer.		

A progressive manufacturer might want American to pull each aircraft off the line for nothing more than a single engine change which from the fiscal side of an engine has been reached.

Overall expense to American will be based on airframe, overhaul costs in relation to that figure. American plans to set a maximum overhaul cost ceiling over which the manufacturer will assume all responsibility.

Several other airlines have approached Allison with similar proposals but as yet no firm commitments have been made. Allison wants to wait until the American agreement is under way before it signs other agreements as a means of developing a new pilot for the airframe commitment it now sits on.

Allison points out that it did not originate nor present the proposal but still adds on the proposal for a similar proposal by American. According to Allison, officials of other carriers become interested and queried the manufacturer about the plan when word spread within top-level industry circles that discussions with American were being held.

If Allison does enter into similar agreements with other carriers, each case will be handled on its own merits. There is no such case will vary, and each agreement will probably call for the creation of a separate leasing subsidiary.

#### Future Agreements

Insurance problems and credit position of the airline coupled with the competitive need at Allison to make the engine designed to order to secure a sale will be the determining factor in making a decision on future agreements. The question of the American agreement, however, will serve as a guideline in determining other agreements.

Allison officials admit their first step across a line to sign engine for cash. However, the company admits that most carriers with other manufacturers have been it to expand the program as more turbocharging engines are placed into operation for this reason, Allison is not pursuing the plan, nor using it as a selling device but is openly considering it. A flight plan to talk with potential customers should sign agreements.

Actually, Allison is hopeful that an independent company will eventually be organized to underwrite leasing programs. The company is in a position to back out of the fact that three engine manufacturers have been forced into the American leasing program with most companies expecting worse to come.

Because of the nature of the pro-

gram, lease contracts are likely to be confined by Allison to domestic carriers. Although the company will undoubtedly consider proposals from the larger foreign flag carriers, it is not presently viewing such possibilities as practical because of currency exchange and other financial complexities involved in international transactions.

#### American's Purpose

Chief purpose of American Airlines in organizing and developing the plan is to reduce capital expenditures. In effect, the airline wants to operate its turbocharging and turbojet equipment without tying up a large volume of capital funds in powerplants, spares and parts inventory. One estimate places the savings to American as capital commitments as a result of the leasing agreement at \$88 million.

The airline will be spared additional capital expenditures for the construction of overhaul facilities by turning over much of its activities to the manufacturer. Elimination of parts inventory costs alone, will result in a substantial reduction of capital expenditures.

The agreement underscores the serious problems the airline industry faces in financing the turbine-powered equipment that competition is forcing both airlines and local service carriers to buy. In its effect on financial

capability, it is responsible to the picture severely set by aircraft manufacturers in accepting orders on the promise of jet aircraft (AW July 7, p. 35).

A number of airline officials feel the period of jet operations arrived sooner than was anticipated by most carriers and arrived virtually in one package rather than in a staggered fashion.

For example, American is faced with the prospect of introducing for the first time in airline history two completely different types of equipment at the same time. Both the Allison turbo-prop powered Lockheed Electra and the Boeing 737 turboprop transport will be introduced into scheduled service at about simultaneously.

In addition, most carriers are now able to place a better estimate on operating and maintenance costs of jet equipment and on spare parts requirements. It has become evident to the industry that a serious shortage of parts is threatened if the demand of the program is to move on schedule unless some outside help is made available.

That additional assistance now will come from the manufacturers and it looks possible that American's leasing arrangements with their engine manufacturers and the trend toward accepting turboprop will open the way to a closer working tie between the builders and operators of jet aircraft.

## No-Show Backers Ask CAB Help

Washington—Many supporters of the three phase no-show plan on banking on Civil Aeronautics Board intervention to block a move by American Airlines to such adoption of a no-show plan at the November meeting of the Air Traffic Conference.

Three carriers, representative of the 22 out of 35 no-shows, incident from one of the present plan's no-showing ruling, asked the Board last week to support and overrule the American offering which would allow the plan to expire in Dec. 1. The tariff agreement between the airlines and the Air Traffic Conference agreement in May with AIC members to drop the penalty clause in Aug. 12 and the recommendation phase is December (AW July 7, p. 29).

Trans World, Eastern National, Delta and Southern have requested CAB aid to not abandoning the plan as a competitive measure which would result from the plan of adopting an alternate "verification" system, which Eastern has labeled a "trouble and inadequate remedy."

General concern of the carriers is that the Board may have sufficient time to act on the no-showing request

before the Aug. 12 deadline for dropping the penalty phase. Delta, in particular, has said that the date is a "death warrant" for no-showing. American Airlines has requested the Board to drop the penalty phase but stated of voting for the Dec. 1 date. Under the terms of a Civil Aeronautics Board approval of an AIC decision to drop the no-showing phase, the Board will lose all power to suspend the American tariff on Aug. 12. Delta declined.

However, objection to the American proposal is not the only factor for CAB action in the dispute on language contained in the current approval granted with certain reluctance by the Board which added it was hopeful something could be done about the matter. Spokesmen for the government agency opposed "cheap answers" over the agreement and indicated the possibility of official action before August.

Delta also criticized an American proposal to drop the plan of adopting a confirmation ruling was an invasion, worse to the public. "Despite the leading action of the question," the airline said, "94% of the passengers questioned indicated they did not seem concerned by the ruling."



Convincer 880 Jet Transport Wing Mated

Right and left wing sections of Convair 880 jet transport are mated at San Diego plant of Convair Division of General Dynamics Corp., after sections had been bolted on a specially-built cone to assure fastening aligned fast tracks. Wing center is first section on Convair 880 assembly line. Wing has a span of 120 ft., a chord of 15 ft., and a dihedral of 7 deg. Right winglet tail boom has a total capacity of 18,770 gal.

## CAB May Act to End Third-Pilot Dispute

By Robert H. Cook

Washington—Civil Aeronautics Board action may be the final factor in settling the both-third-pilot dispute.

Under the terms of the dispute, the Board has different findings from two past decisions but finding partly investigating the problem at Eastern and Trans World Airlines.

While the Board in the past has adopted a hands off policy in the two-year battle between the Air Line Pilots Assn., the Flight Engineers International Assn. and the airline on the grounds that it has been a labor-management dispute, CAB has now turned both emergency board reports over to its Bureau of Air Safety for study. Airline findings by the Bureau regarding flight engineers on transport have been in the past, should mean TWA pilots' Dr. E. Whiting, acting as a member of the board and the proposal should settle an disagreement between the union and the airline and recommended that TWA continue its policy of setting its own standards for flight engineers as it has for the past 29 years.

Regarding the possibility of government intervention at the third crew member position, the board and that of Civil Air Regulations should be changed to require pilot qualifications for flight engineers, it would be "no fault of the company" and the expense of training should be borne at the company's expense.

that flight engineers taking pilot training would probably do so on their own time but at company expense.

Facing the possibility of the safety factor involved in the dispute, the Board has recommended that while the Civil Aeronautics Board's action under in 1946 establishing the need for flight engineers and their requirements, can be met with either pilot qualified to maintain qualified engineers in flying between the two unions posed a threat to the degree of cooperation "best" in operations as created as that of living engineers.

#### TWA Ruling

Emergency board considering the Flight Engineers International Trans World Airlines configuration rule recommended that a flight engineer, as well as two pilots, should mean TWA pilots. Dr. E. Whiting, acting as a member of the board and the proposal should settle an disagreement between the union and the airline and recommended that TWA continue its policy of setting its own standards for flight engineers as it has for the past 29 years.

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engineers' expense and as their own time. Should the airline change its current configuration, then the flight engineers should receive pilot training at company expense, the report said.

The board also recommended adoption of a clause that flight engineers should be selected from the FAA's records list at TWA as job search agents are change in present government regulations, provided the airline agreed not to enter into a contract concerning the engineers with any other union.

If the government makes the pilot requirements mandatory, Whiting said TWA probably would face difficulty in having qualified personnel from the company's ranks and should therefore, be allowed to hire from its own company qualifications wherever possible.

#### Engineers' Stand

Safety did not enter into the discussion in recommendations at TWA as it did in the Eastern case, making the case, presents a matter of its own, according to spokesman for the Flight Engineers International Assn., which pointed out that Whiting was confronted with a TWA flight engineers agreement that the third crew member be a flight engineer, making it necessary for his report to go beyond the accepted agreement.

An Air Line Pilots Assn. and the Flight Engineers were both involved in the



## WHY VANGUARD ASSURES GREATEST ROUTING FLEXIBILITY

The great new Vickers Vanguard will introduce the most amazing mix of range and payload capacity—plus the widest-open maneuverability of jet-propelled transport—into 200 all the way to 2500 miles. What's more, the new Vanguard can be operated from any "Victroland" airfield.

### Unmatched on all ranges

TCA recently opened two extra-long-range jet air services—both jet-propelled and pure jet. They found that the Vanguard could be most economical of all for these high-range, medium-weight routes. Other airlines have shown that the Vanguard, because of its large size and low break-even load factor—below 18¢/lb on stages from 200 to 2500 miles—will offer the biggest profit potential of any aircraft in its class.

120 mph plus 2500-mile range ... up to 140 passengers ... up to 20 tons of freight

NEWEST FROM THE WORLD LEADER IN JET-PROP AIRCRAFT ...

# VICKERS VANGUARD

POWERED BY FOUR ROLLS-ROYCE FIVE BRITONS

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Eastern decreases because of strike votes which were defeated by creation of the emergency board. ALPA was not a party to the TWA decision but is currently negotiating a new contract with the airline and has announced that it will demand that freed crew members be certified as pilots, regardless of the emergency board recommendations.

Meanwhile, TWA flight engineers last week signed a new contract with the airline to include the job security measures proposed by the presidential fact finding board.

New contract, which expires Jan. 1, 1961, calls for salary hikes of from 5% to 14% on union equipment plus an additional 35% for jet work on Boeing 707s and Constellation. About 700 flight engineers are involved.

The engineers' union feels the Eastern agreement will be "irrevocable to all concerned" and human ALPA's stand for a final question pilot for safety as "an old man" to further the job security of pilots in the future. The union refuses to accept the board recommendation in this case and says it will "seriously consider" a strike vote after the 30-day waiting period imposed by presidential order.

American Airlines, now involved to a third man strike with ALPA below the Emergency Board, is strongly opposed to the Eastern Engineers' standing. "There is no need for the services of a third pilot."

C. R. Smith, president of the airline, and American will not sue pilots as the board says neither union directed to do so by the Civil Aeronautics Board. The airline has an agreement with its flight engineers which has nearly five years to run.

## Antonov Defends Ukrainian Design

Moscow-Soviet designer G. K. Antonov has vigorously defended the design of his four-engine propeller An-30 Ukrainian transport against Russian critics who complain that the high-wing aircraft looks odd balanced and that its fuselage is too fat and heavy.

Writing in the official Russian civil aviation magazine, Gostekhnicheskaya Armia, Antonov retorts that while the An-30's fuselage with its short, abrupt seating area flat when viewed from close up, the aircraft shows its true proportions in flight "and in our opinion is a pretty ship."

Admitting that the An-30's fuselage is somewhat heavier than fuselages in foreign transports of its class, Antonov says this is no cause for criticism since the Ukrainian pushed to greater. In addition, he claims that the An-30's fuselage and tail sections are considerably sturdier.

Tuning in to the An-30's high-wing configuration, Antonov declared:

Suspending the engines beneath the high-wing increases the plane's lift drag ratio by 2.5 units depending on the condition of flight decreases fuel consumption 10-15%; permits use of the most efficient engine and cuts loss of engine efficiency through load-poorment.

With the engines higher off the ground, foreign objects are less likely to be sucked into the compressors. Fuel tanks and other vital parts are easily protected from the perils.

Engineers believe on rough water landings would be easier in high-wing An-30s than the propellers could not absorb fast landings' movement along the surface.

Passenger entrance doors can be located more conveniently under the wing. With the fuselage nearer the ground, high landing troops are unobstructed. The high-wing permits good views from all windows in the passenger cabin, and the seat's reflexions don't glare at the passengers' eyes.

Russian Air Force reports: Soviet Union Airlines, via addition of outboard fins on the Antonov An-10 four transport transport's stabilizer (AW Feb. 28, p. 35) aims to correct tail stability which developed in the first model Ukraina at low speeds, "especially during takeoff."

## British Airline Traffic, Capacity Increases

London—Although British airline increased capacity in fiscal year 1957-58 by more than 15%, total traffic carried increased only 11%.

Figures published by Ministry of Transport and Civil Aviation show that the airlines offered 512.4 million ton miles during the year, 15.1% more than in 1956-57. Total traffic rose to 514.3 million ton miles.

While mail traffic remained at the 1956-57 level of 23.6 million ton miles, freight traffic rose 9.7% to 56.7 million ton miles. Total million passengers increased 14.4%—from 2,450 million passengers in 1956-57.

Overall load factor for the year fell from 65.4% to 59.2%.

British Overseas Airways Corporation provided 313,285,000 capacity ton miles, 11.9% more than in 1956-57. The airline flew 498,370 passengers—a 16% increase—1,527 million passenger miles, 16.5% more than in the previous year. Commercial freight-carrying rose 6.6% to 4,911 tons. Load dropped slightly by 5% to 4,174 tons.

British European Airways Corp. offered 119,465,000 capacity ton miles on scheduled services, an increase of 15.4% above 1956-57. International capacity increased by 44.8%.



## Japanese Design Turboprop Transport

Japanese turboprop transport, now being designed by Transport Aircraft Development Association, has been designated FB-10, will carry 60 passengers. Aircraft will be produced by two firms. First 10 engines, producing 2,687 hp, each and prototype is expected to be by Kawasaki. FB-10 engines, Douglas says FB-10 can also be designed as a two-engine configuration. Two-engine design calls for cruising speed of 295 mph, range of between 374 and 622 mi. Project will cost estimated \$10 million. Make: high speed jet into FB-10 model. Aircraft previously was designated FB-10A.

# The BEST WAY is by TWA



Dave Chasen, noted Beverly Hills restaurateur, approves a great entrée.

## Sirloin of beef...broiled to your order in flight!

Your Ambassador flight turns toward the evening sun. Dinner is served—a celebrated event on TWA. You begin with cocktails, you conclude with coffee, a choice of Equeurs, and a satisfied sigh. But the high point, an airline innovation by TWA chefs and Dave Chasen, is a culinary masterpiece—a tender cut of prime sirloin of beef broiled to flight to individual taste. All this, of course, part of a most pleasant and rewarding trip by TWA Ambassador.

FLY THE PINEST...FLY **TWA** TRANS WORLD AIRLINES

## SHORTLINES

► Alaska Airlines reports a net income of \$410,147 for the fiscal year ending Oct. 31, 1957, in its annual report which was recently released. The 1957 net income compares with \$391,302 for fiscal 1956. An operating loss of \$215,459 was offset by a capital gain from sale of aircraft and other assets totaling \$662,666. Revenues for the year were \$5,961,977, off \$347,206 from 1956.

► Capital Airlines is fighting tugger land action with newly authorized "VIP" flights between New York and Chicago, Detroit, Atlanta and Denver and between Chicago-Washington and Washington-Memphis-St. Paul. At no time does the flight offer cock-tails, steak dinners and other deluxe service. The service is now available on 16 Capital charter flights and is expected to be expanded to other major points on the airline's system.

► Los Angeles Department of Airports has awarded a \$977,968.66 contract for reconstruction of runway 27R at International Airport. The Gierlach Co., of Los Angeles low bidder on the project, began work on Aug. 1 and is expected to complete the job about Dec. 1. Since 1945, when airlines began using the runway, several airports, nearly two million aircraft have used the runway for landings and takeoffs.

► Transocean Air Lines is spending an airfield study contract with the Mutual Command to provide USAF distances in the Pan Zone with three refueling too miles of passenger and freight change during a three-month period. Transocean is spending a fifth round trip flight testing USAF bases in Japan, Okinawa, Formosa and the Philippines. The flight originates and terminates at Tientsin-NYB near Tokyo.

► United Air Lines flew 521,811,000 revenue passenger miles during June. Revenue airplane miles was 12,164,800, or more, including first class, 2,351,040 ton miles; cargo, 767,067 ton miles and freight, 4,877,800 ton miles. All figures represent an increase except freight ton miles, which were 7% below those of June, 1957. United has signed an cargo rate-price agreement with two all-glass airlines to see through cargo agreements over United's system and connecting routes to foreign countries. The carriers, Aerovial Sot Americana and Societal Aeromexico Medellin, San Florida points to Guatemala, El Salvador, Panama, Colombia, and Ecuador and seven principal Colombian cities respectively.

## AIRLINE OBSERVER

► Northeast Airlines will introduce its first Viscount turboprop service on Aug. 21 with four flights daily between Washington and Boston. (An additional plane in its order for use (AWP July 21, p. 20) are delivered turboprop service will be expanded to include routes including between New York, (LaGuardia) and Washington. The new schedule is a major step in the carrier's long-range development program designed to establish greater identity in the East Coast market and to capture a larger share of the New York-Florida trade. In addition, Northeast hopes to balance out its relatively light schedule, travel in opposed to its heavy weekend vacation traffic by attracting more business by Viscounts.

► Proposed Lockheed turboprop aircraft probably will bear little resemblance to the Electra transport and will require an initial order of at least 35 aircraft before production can be considered. While it would utilize the same Allison turboprop powerplants as the Electra, much of the design, such as wing loading, will come from the C-130. Engines also will be much larger than the Electra with a reported gross weight of 145,000 lb. as compared to 116,000 lb. for the passenger aircraft.

► Pan American World Airways plans a domestic exhibition tour for its first Boeing 707 jet transport that will begin by beginning immediate service. Domestic aircraft are not happy about Pan American bringing the first jet transport to many of their major U.S. traffic points first and feel that the Pan Am tour will take much of the stress out of their own promised plans for expansion of jet transport service.

► Lockheed plans a seven week European sales tour for its turbo-prop-powered Electra that will follow, by a promotional trip to the International Air Transport Assn. annual meeting in New Delhi, India, in October.

► El Al Israel Airlines is honoring one of the first Bristol 365 Britannias ordered and then cancelled by Northwest Airlines. Bristol Aerospace Co. announced the long pending completion of El Al's fourth Britannia 315 with serial one. Cost of the aircraft lost will be deducted from cost of the final 313, according to Bristol spokesman. Authoritative sources in Tel Aviv report El Al also plans to replace its European route Constellations with medium-range Caravans or Caravelles soon.

► Airways Maintenance Board has awarded a \$542,370 contract for a new and more detailed survey of air traffic conditions across the nation. Contract was awarded to the Chicago management consultant firm of Ross Allen and Hunsicker. Estimated time to complete the task is six to 12 months.

► Rolls Royce Dart engine used on Trans Canada Airlines' Viscounts has been certified for a 2,000 hour overhaul schedule by the Canadian Department of Transport. TCA started Viscount operations in April, 1955, with approved Dart overhaul at 1,850 hours. Second highest overhaul limit for the prop-jet engine is held by Capital Airlines which last May extended the overhaul period to 2,500 hours.

► Four BOMC de Havilland Comet IV jet transport last week returned to England from tropical tours in Africa including last down take-off and wing tests. Comet IV flew the 1,211 air. Entebbe-Rome leg of its return trip to Hatfield, England with full payload in 6 hr., 49 min.

► Flying Tiger Line extended the highest volume of airfreight ton miles flown by any U.S. carrier in April. CAB records show that the Chicago carrier flew 5,202,771 ton miles. Its closest competitors, Pan American and American Airlines, flew 3,557,684 and 3,147,091 ton miles respectively.

► Air France last week began direct service to Moscow with a twice-weekly schedule using Caravelles 1490C. Caravelles Aeroflot began a similar operation using its Tu-104 jet transport. Tourist class has between New York and Moscow in \$598.70 one way, \$998.70 roundtrip.

# Electra

The Lockheed high-priority prop-jet transport for

## SPECIAL AIR MISSIONS

Meeting the existing requirements of the U. S. Air Force and the Military Air Transport Service, the Lockheed

ELECTRA offers unexcelled safety, comfort, age-prime and performance for this most vital service



### SUMMARY OF SAFETY AND OPERATIONAL FEATURES:

#### HIGH PERFORMANCE:

The ELECTRA has exceptional power-to-weight ratio, safety takes off from short fields, climbs fast even at top engine and high gross weights.

#### IMMEDIATE POWER RESPONSE:

The ELECTRA's four constant-speed Allison Prop-Jet Engines respond at once—no delay for engine speed and power buildup.

#### COMPACT:

Streamlined, pressurized, streamlined cabin and vibration-free smoothness of synchronous phase prop-jet power makes the ELECTRA outstandingly quiet and comfortable on long or short flights.

#### LARGE FUEL CAPACITY:

Special fuel provisions permit non-stop flights of over 3050 nautical miles with 400 passengers and baggage. Including fuel reserves for an additional 96 hours.

#### RAPID DESCENT:

Extended Fowler flaps and high wing down flight—no propeller pitch change—enables the ELECTRA to descend very rapidly from cruise altitudes.

#### POSITIVE REVERSE THRUST

Propellers: Main electrically reversible propellers available for routine operations even under adverse engine and line conditions.

#### FAIL-SAFE STRUCTURAL DESIGN:

Optimum structural integrity built into all components ensures maximum safety under all flight conditions.

#### EXCELLENT VISIBILITY:

The ELECTRA's "head office" establishes new standards of visibility for pilots of transport aircraft.

#### FAST:

The ELECTRA flies 100 miles faster than present special military transports.

#### ECONOMY:

Efficient operation at low cost even at high altitudes, yields economy even on thermal flights.

## Airline Income & Expenses—April, 1958

(IN DOLLARS)

	Passenger Revenue	F. & M. Fuel	Expense	Flight	Chamber	Total Operating Revenue	Total Operating Expense	Net Income Before Taxes
<b>DOMESTIC TRAFFIC</b>								
American	31,227,444	391,212	2,941,431	138,278	79,354	38,146,240	33,487,397	1,762,333
Boeing	4,421,420	124,976	80,140	138,278	5,344	4,534,120	4,494,464	39,656
Capital	8,091,240	293,426	83,703	154,739	15,830	8,384,795	8,442,344	(57,549)
Continental	1,795,440	45,112	13,392	41,301	8,842	1,846,180	1,848,381	(22,201)
Delta	4,496,110	158,245	73,713	381,245	381,245	5,030,400	4,743,941	286,459
Eastern	31,246,410	342,715	2,941,431	138,278	79,354	38,146,240	33,487,397	1,762,333
Northwest	2,243,128	70,861	17,462	42,371	32,891	2,346,252	2,243,221	103,031
Southwest	3,028,444	12,368	12,368	37,714	12,368	3,157,496	3,088,618	66,878
Texas	4,157,234	149,898	262,140	12,368	12,368	4,379,400	4,214,419	164,981
Trans World	12,474,000	337,000	179,000	443,000	12,000	12,624,000	12,414,000	210,000
United	31,480,866	614,499	264,258	793,574	79,354	32,343,247	31,210,247	1,133,000
Western	1,480,866	1,571	1,571	1,571	1,571	1,480,866	1,480,866	0
<b>INTERNATIONAL</b>								
American	446,889	5,261	79,395	138,278	79,354	541,223	479,353	61,870
Boeing	459,507	1,173	1,173	138,278	5,344	474,864	474,864	0
Capital	136,140	5,648	4,611	138,278	1,969	147,737	147,737	0
Continental	347,867	5,261	1,173	138,278	79,354	381,245	381,245	0
Delta	1,011,533	33,079	47,411	381,245	381,245	1,432,098	1,370,499	61,599
Eastern	4,496,110	158,245	73,713	381,245	381,245	4,977,350	4,743,941	233,409
Northwest	136,372	3,669	1,173	138,278	79,354	147,737	147,737	0
Southwest	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
Texas	170,201	12,368	12,368	138,278	1,969	184,546	184,546	0
United	5,411,801	614,499	264,258	793,574	79,354	6,094,970	5,894,970	200,000
Western	5,411,801	614,499	264,258	793,574	79,354	6,094,970	5,894,970	200,000
Passenger	1,815,000	44,768	149,000	149,000	149,000	2,013,768	1,965,000	48,768
Trans-World	4,496,110	158,245	73,713	381,245	381,245	4,977,350	4,743,941	233,409
United	4,496,110	158,245	73,713	381,245	381,245	4,977,350	4,743,941	233,409
Western	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
<b>LOCAL SERVICE</b>								
Allegany	15,341	2,499	4,124	138,278	79,354	1,147,264	751,264	396,000
Boeing	242,371	2,499	1,407	138,278	5,344	249,384	249,384	0
Capital	136,140	2,499	1,407	138,278	5,344	147,737	147,737	0
Continental	347,867	5,261	1,173	138,278	79,354	381,245	381,245	0
Delta	126,427	4,473	8,411	381,245	381,245	508,124	514,614	(6,490)
Eastern	326,649	1,173	1,407	138,278	5,344	333,167	333,167	0
Northwest	136,372	3,669	1,173	138,278	79,354	147,737	147,737	0
Southwest	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
Texas	170,201	12,368	1,407	138,278	5,344	184,546	184,546	0
United	5,411,801	614,499	264,258	793,574	79,354	6,094,970	5,894,970	200,000
Western	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
<b>RAVIAIR</b>								
Newark	490,201	3,669	1,407	138,278	5,344	498,167	479,424	18,743
Trans-World	141,228	2,499	1,407	138,278	5,344	149,070	149,070	0
<b>CARGO LINE</b>								
American	3,011	3,770	45,442	138,278	79,354	44,223	44,223	0
Boeing	136,140	2,499	1,407	138,278	5,344	147,737	147,737	0
Continental	347,867	5,261	1,173	138,278	79,354	381,245	381,245	0
Delta	126,427	4,473	8,411	381,245	381,245	508,124	514,614	(6,490)
Eastern	326,649	1,173	1,407	138,278	5,344	333,167	333,167	0
Northwest	136,372	3,669	1,173	138,278	79,354	147,737	147,737	0
Southwest	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
Texas	170,201	12,368	1,407	138,278	5,344	184,546	184,546	0
United	5,411,801	614,499	264,258	793,574	79,354	6,094,970	5,894,970	200,000
Western	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
<b>WORLDWIDE SERVICE</b>								
Allegany	15,341	2,499	4,124	138,278	79,354	1,147,264	751,264	396,000
Boeing	242,371	2,499	1,407	138,278	5,344	249,384	249,384	0
Capital	136,140	2,499	1,407	138,278	5,344	147,737	147,737	0
Continental	347,867	5,261	1,173	138,278	79,354	381,245	381,245	0
Delta	126,427	4,473	8,411	381,245	381,245	508,124	514,614	(6,490)
Eastern	326,649	1,173	1,407	138,278	5,344	333,167	333,167	0
Northwest	136,372	3,669	1,173	138,278	79,354	147,737	147,737	0
Southwest	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
Texas	170,201	12,368	1,407	138,278	5,344	184,546	184,546	0
United	5,411,801	614,499	264,258	793,574	79,354	6,094,970	5,894,970	200,000
Western	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
<b>ALASKA</b>								
Alaska Airlines	120,440	45,932	840	36,248	74,495	162,184	162,184	0
Alaska Coast	34,932	7,119	1,173	138,278	5,344	47,411	47,411	0
Continental	347,867	5,261	1,173	138,278	79,354	381,245	381,245	0
Delta	126,427	4,473	8,411	381,245	381,245	508,124	514,614	(6,490)
Eastern	326,649	1,173	1,407	138,278	5,344	333,167	333,167	0
Northwest	136,372	3,669	1,173	138,278	79,354	147,737	147,737	0
Southwest	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241
Texas	170,201	12,368	1,407	138,278	5,344	184,546	184,546	0
United	5,411,801	614,499	264,258	793,574	79,354	6,094,970	5,894,970	200,000
Western	1,418,000	33,079	228,274	138,278	1,969	1,649,240	1,599,999	49,241

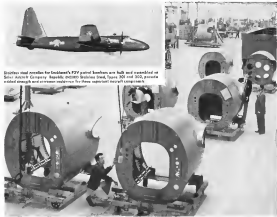
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# Problem-Solving Products from Republic Increase Strength, Withstand High Temperatures, Fight Corrosion, Provide Production Economies



Greater steel needed for Lockheed's P-2V patrol bombers are built and assembled at Solar Aircraft Company. Republic stainless steels, Types 301 and 302, provide added strength and corrosion resistance for these important aircraft components.

REPUBLIC ENDURO® STAINLESS STEEL HELPS SOLVE strength, heat, and corrosion problems in engine nacelles for the Navy's P-2V patrol bombers.

Complete nacelles are built by Solar Aircraft Company, San Diego, California, pioneers in stainless steel engine construction. To date, Solar has manufactured more than 1000 nacelles for Lockheed's P-2V program using A-164, Types 301 and 302 Stainless Steel.

The standard use construction of these airframe units offers a number of advantages including greater strength, ability to withstand high temperatures, less maintenance for protection against corrosion and more economical production processes.

Republic ENDURO Stainless Steels, Types 301 and

302, provide needed strength, yet permit the use of lighter gages to save weight. They are highly resistant to atmospheric corrosion, erosion, and oxidation at high temperatures. They are readily formed into desired shapes by the usual conventional methods.

Like Solar, Republic is also a stainless steel pioneer. Republic metallurgists and engineers pioneered the development of these high strength-in-weight, heat-resistant, and corrosion-resistant metals. To help you use them to best advantage, Republic offers you the services of its famed 3-Dimensional Metallurgical teams—field, oil, and laboratory metallurgists. The coupon is your invitation to use this confidential and obliging service.



**HAIRY STEEL WELDMENTS** meet high strength, precision requirements in B-57 bombers. The welding technique developed by Hale Aircraft Corporation, Olathe, Kan., California, is currently being used in the manufacture of B-57 tanks for the Air Force Bomber program. The material used is ARS 4428 Alloy Steel, a type supplied by Republic. The fine steel provides a uniform tensile strength of 180,000 psi in the heat-treated condition. Uniform regions in heat treated steels means exceptionally good deep bending characteristics—plus hard wear resistant surfaces. Specify Republic Alloy Steel for your parts that need high strength, dependable. Our metallurgists will help you find coupon for tests.



REPUBLIC DEVELOPS NEW POWERS for structural, electrical, and electronic part applications. Type 40 is soft, higher purity powder with superior carbon permeability. It can be used for complete strength structural parts at lower cost than ductile with coupon. It is also directly useful for use in fabricating pipe parts pressure margins, tanks, structures, etc. ARS Powder 40 is used in fabricating larger parts on normal pressing equipment. Send coupon for complete details on physical properties, chemical composition, and analyses.



**TITANIUM FOR WHEAT SHUCKER** is the Navy's Regent. Because of its light weight and high strength features, titanium is currently being used for many applications in both military and aircraft. It is resistant to corrosion and has a high strength-to-weight ratio. Titanium is extremely high corrosion-resistant under all conditions for tanks to hold acids used in production with acids. Heat, acid, the example, has negligible effect on titanium. It is particularly immune to salt water and sea corrosion. Republic produces titanium in all commercial forms. Republic's metallurgists will help you supply titanium in the best working steel coupon for more facts.

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Ground support equipment for the Nimbus and the X-15 developed a new concept for check-out trailers, engine run-up dollies, instrumentation check-out consoles, hydraulic servicing units, ground power units, jet engine starters, ground cooling cars, ground hydraulic power supplies, ground pressurization equipment, ground fire-fighting equipment, scales and support stands, or transportation dollies, and a wide range of other test and launch components.

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Phyllis Kaitera, *Executive Director*



between certain peroxide effects at 10° and 30°. He and his colleagues at National Research's Vice President Fredrick H. Conroy Jr. think the reactions can produce, for example, a flame pattern that is common at 10°; it will be close to the same configuration at 30°. And, looking at it another way, if something won't work at 10°, it is a pretty safe bet that it won't work at 30°.

Neurobiology. National Research is already at work on the problem of producing a vacuum test chamber that will go down to  $10^{-6}$  or  $10^{-7}$  M Hg. Physicist plans call simply for a static test

With a 50-psi. pressure, he's a distance champion of the power tool. (Hoffman has a large 50-psi. hot-chamber which can be reduced down to 10" psi.) He and the company use a good slush of producing men with speeds of 100,000 to 1,000,000 kps. per second and having electric pressures 10 to 100 times lower than power plants.

As to the present proposed facility it will be a case of setting up a casting mold around and inside, possibly, of glass to the use of the strength required. It can be used with great knowledge, the company says for the time it will be built.

Beyond 10<sup>-5</sup> was Hg, the redox problems got very involved for the high vacuum conditions. It is at this point that helium and krypton start

diffusing through the solid is still of the same character, except the pressure. But for the present at least, National Research cigarettes aren't moving about the high vacuum problems beyond  $10^{-6}$  in connection with rocket engine testing. Other work, the cost part is doing, however, such as molecular beams does reach down to below this point. The primary application for each test character, then, before, is as infinite money, which will operate comfortably within the technological limitations of available or attainable high vacuum equipment.

Even a domestic space chamber with a 10<sup>6</sup> capability, such as the one proposed, will mean high altitude rocket research a big step forward, they declare, and is almost guaranteed a small but useful market.

In talking to propulsion experts, National Research discovered that many of these were disheartened with the limits of present propulsion equipment. Actual rocket flights that took altitude 500,000 were a very expensive research tool and still are far from a satisfactory one. National Research found what was wanted is a high altitude rocket test chamber: proved these requirements in next test and technological considerations and came up with a proposal for a space chamber that will occur the following considerations:

- Initial pressure will range from 10 to  $10^4$  new. It is important to roughen to 100 or so aluminide. Processes during firing may be somewhat higher, depending upon percentage of new combustible combustion gases and other factors.
- Chamber is designed to handle solid and liquid propellants of molecular weight between 18 and 28, having heats of combustion up to 25,000 Btu/lb and with burning temperatures from 2,900 to 2700°C issuing from the nozzle.

- Burning rate will be at least 700 lb of propellant per hour at a propellant oxidizing combustion gases of which 50% are non-condensable at 1780°
- Burning time will range from three hours of a second to 5 or 10 min.
- To avoid assistance for repeated pump-down cycles even, time a new rocket is inserted, unit will have a small air lock with a separate pumping system.

Humidity in the upper atmosphere will be measured by neutral buoyancy sondes in a case of Nike-Cajon high altitude rocket rocket for IGH program. Balloonborne neutral sulphide photolysis is necessary to form of sunlight which is currently proportional to amount of water vapor in the atmosphere between instrument and the sun. Optical system is automatically shielded with respect to sun, regardless of rocket's pitch, yaw or attitude control.

The test chamber itself will be 100 ft long, 12 ft in diameter, and will be made of austenitic stainless steel which is non-magnetic and highly corrosion resistant. It will be fully instrumented, heavily insulated and housed in its own building. Smaller buildings for housing the liquid nitrogen plant, instrumentation and control rooms and offices will also be on the main building.



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ANALOG

**Does the job of gyros 12 times heavier—new 8-oz. Honeywell MIG (miniature integrating gyro).** With a maximum drift rate of only one-half degree per hour or less and a random drift uncertainty of .05°/hr.—even after subjection to severe environments—the MIG's performance equals that of hermetic integrating gyros many times its size and weight.

#### Specifications

**Weight**—0.55 lb.  
**Size**—1.43 in. diameter by 2.58 in. long

**Applications**—Platform gyro for an accelerometer in compact space. All-weather reference and control applications.

**Drift Rate**—One-half degree per hour or less under all conditions.

**Accelerate Coefficient**—0.1°/hr./g force

**Power Requirements**—15 volt, 3-phase, 400 cycle per second supply and 215 volt a.c. or d.c. heater supply.

**Exciting Power**—125 watt, 3-phase, 400 cycle per second supply.  
**Signal Amplitude**—100,000 cps, 0.1V.

**For further information** contact Honeywell Army Division, Dept. AW-6-1, 5500 Highway 50 East, Minneapolis 15, Minnesota.



Photo shows MIG gyro with computer unit, GCH Precision Accelerometer (left). GCH has developed a total g and intensity of laser class 1B up to 10 g.

## Honeywell

**H Military Products Group**

Research was only the first step. Now more goes into the design. This is how the proposed facility will work.

The inlet vapor will be placed in the test chamber, which will be closed and evacuated with conventional roughened and diffusion high vacuum pumps. But as will be circulated through the chamber, perfect during the test, is used to facilitate outgassing, removal of gas molecules trapped in solid materials.

Most of the sample heat is the extra will be removed in fast convection, the air and then passing it through an expansion turbine, which will then be pumped into the space surrounding the test chamber for the fast cooling down.

In the proposed system, the gas of liquid nitrogen (which liquefies at -192°) serves a dual purpose: it simulates the temperatures found in space and it acts as an additional pump, helping to remove residual gases and contamination products which condense at liquid nitrogen temperatures.

During the inlet firing, the condensation will be pumped using liquid nitrogen and cryogenic pumping techniques and the noncondensables will be removed by diffusion and mechanical pumps. A special evidence and real refrigeration system probably will be placed in the test chamber at the opposite end from the inlet engine to reduce the buildup of any noncondensable combustion products at this spot, as pointed as a result of the jet exhaust action.

Construction of the facility will take 30 months from the date of contract according to National Research, and will be carried out in three phases. First the company will design, build and operate a pilot plant to test theoretical conclusions and to give additional data. Laboratory ground here will be used as the basis for the final design.

Next, the company will prepare detailed specifications and final drawings and will submit bids from potential subcontractors. The final phase will be construction of the full-scale facility.

Professor Williams explains that the total cost of the test facility runs up to high as \$6 million. But the company doesn't believe price will prove a major deterrent to those who can use a facility such as this. "While the cost might be too high for some agencies or companies, the individual groups could get together and undertake the system, partly. A short time ago, according to National Research the chamber could not have been built at any price. Large high vacuum static test chambers, of course, have been available for some time. But it was only within the past year or two the company realized that its researchers must shift to scale up the laboratory techniques.

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Kearsfott offers the widest range of synchros on the industry. Ruggedly constructed of corrosion-resistant materials, they give unexcelled performance under every environmental condition. For best characteristics and reliability, specify Kearsfott line of precision synchros. Here are a few typical models.

**Size 8:** 750° ± 1.384° 1.25 in. — 54C to +105C. Available in transmitter, control, transmitter-receiver, and differential. Max. error from E0: 10, 7 and 5 minutes.

**Size 11 Standard:** 1.062° ± 0.170° 1.4 in. — 54C to +120C. Available in transmitter, control, transmitter-receiver, receiver and differential for 10 and 150 applications. Max. error from E0: 10.7 and 5 minutes standard, 3 minutes in severe conditions.

**Size 11 MIL Type:** Datasheet and applications same as above. Meets DoD configuration and max. error from E0: 5 minutes.

**Size 15 Precision Receiver (R347):** With compensating network and space integrated booster amplifier, provides 1:1 transformation ratio, 9° phase shift. Max. error from E0: 5 minutes.

**Size 25 Ultra-Precision:** 0.036° ± 0.007° 45 in. Available in transmitter, differential, and control transmitter-receiver. Max. error from E0: 20 seconds max.

**Signature:** Kearsfott offers the highest accuracies in standard component and system developments.



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#### MAKES ANY PLANE A TANKER

An Aeroquip fuel-tethering four-bladed turbine provides all the power needed for pumps and nozzles in the self-contained "Buddy Store" that turns fighters or attack bombers into aerial tankers in split seconds. This first successful non-air-powered tanker kit is lighter and more streamlined—needs no plumbing or power from the tanker plane.



#### COOL PERFORMER FOR HOT JOBS



Proven in severe tests from ambient to 1000°F, the new Aeroquip high-temperature linear hydraulic actuator makes dependable operation of thrust spools and thrust reversers possible. Now being supplied to Marquardt Aircraft Company for incorporation in a complete reverser system, its patented fluid flow and seal system reverses heat rapidly and continuously—provides positive seal—ensures smooth, dependable operation. Patented synchronization system permits reposition installation. If required, a patented self-locking feature automatically holds reverser or spool in fixed position if power fails.



The four examples shown here—each tops in its field—are only a part of the Aeroquip story. Aeroquip's proved design ingenuity and production know-how are now speeding the solution to many "sticky" airborne accessory problems on commercial and military aircraft and on missiles and rockets. Aeroquip engineers are ready today to consult on your projects—classified or unclassified. Write.

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Designing for tomorrow*

## Aeroquip

ALLISON DIVISION OF GENERAL MOTORS, DAYTON, OHIO



#### BEATS THE ICE BARRIER

New Aeroquip ICEFOIL is specially designed for installation in gas turbine intake ducts—activates de-icing systems at speeds from 50 to 500 knots—meets requirements of MIL-D-8181 plus 2000 cps @ 150 Vibration Test plus 1450 ft./lb. ice-ball impact.

Test: In extensive wind tunnel tests, the ice/ice cycle time varied only 3%.

#### HEAVYWEIGHT POWER FROM A LIGHTWEIGHT PACKAGE

This air-driven generator weighs only 22 pounds—delivers 1.7 KVA for the Navy's A-4D carrier-based bomber, is scheduled for later versions of the A-4D. It has the highest power-to-weight ratio of any test of its type—uses a simple blade pitch-changing mechanism to get up to speed in less than 1/10th second.



# NEW limit switchless actuators



Reduce weight and cost 25% below conventional design

A reduction in actuator cost and weight up to 25 per cent, with similar maintenance savings, has been achieved through the advanced design of AirResearch electric limit switchless actuators for aircraft and missiles.

Elimination of limit switches in power actuators is a result of AirResearch development of a rugged high temperature motor and a sensitive non-jumping positive stop.

Limit switches are discarded by two methods. 1) use of incompressible and high temperature liquids. 2) use

of high temperature motors with thermal generators which provide movement as long as the duty cycle.

Additional advantages of AirResearch limit switchless actuators, they are smaller, less complex and the possibility of limit switch failure is eliminated.

On closure of limit switchless actuators, reliable, long-life actuators are producing more than a million units and more units. Current production includes several hundred actuators types, many with high temperature applications.

Test inquiries are invited.

- A Jet Actuator, CORVUS 8.38
- B Jet Actuator, LOCKWELD F104
- C Jet Actuator, CORVUS 8.38
- D Jet Actuator, CORVUS 8.38
- E Jet Actuator, CORVUS 8.38
- F Jet Actuator, CORVUS 8.38
- G Jet Actuator, CORVUS 8.38
- H Jet Actuator, CORVUS 8.38

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# Ground Testing May Ease Space Problems

By Richard Swerney

Los Angeles—Human factors problems of man in space are not all discussed by engineers and scientists as they advance in space technology, since some focus such standards review as letters from people interested in space technology.

In solving this incident of how a problem was brought to the attention of medical investigators. Dr. Norman Whitlock of Convair told a session of the National Business Meeting of the Institute of Aeronautical Sciences here that the problem raised by the letter writer was the relationship of the earth's electromagnetic field to the location of the human body, a consideration taken for granted which may require quite a bit of physiological and psychological adjustment on the part of space crews.

Many problems of human in space remain unsolved and new problems are constantly being discovered, Dr. Whitlock said, adding that ground testing can anticipate and in solving human problems and discovering new ones.

## Space Voyage Problems

Dr. Whitlock's paper dealt with data on man's metabolism and the problems which arise from it in long term space voyages, such as growth of the human system, slow decomposition, difficulties in intake and output of the human system, and ground testing for manned space flight.

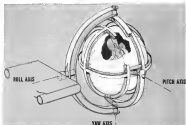
Realistic values required to support man above 70,000 ft. was termed by Dr. Whitlock as a Life Support System (LSS) and that the such alternative is a closed gas-controlled life support system such as is used in today's airplanes. Only one sealed cabin, Whitlock told, is that at USAF's School of Aviation Medicine, and Convair's Astronautics Division makes his proposal in a light weight, compact, flight worthy article.

Convair feels, he explained, the man and his entire Life Support System should just float through the combined stresses of flight while on the ground, as part of flight without evaluation. He added that a proper man-machine mental test facility can simulate all but two features of space flight—high-altitude and isolation, relative freedom would include the USAF's closed facility at Convair's Astronautics plant, and a space chamber beside the facility. These would simulate launch and re-entry and also in free space flight except for the weightlessness and sensory isolation.

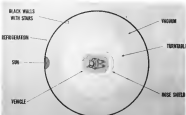
Stresses encountered in sealed cabin,



ACCELERATION of 18Gs can be simulated on Convair's Astronautics Div., San Diego, Calif. Equipped post flight ground test can only test of methods.



CENTRIFUGAL cables mounted on them can free products (shock, vibration, type recording, looking elements, sensors) and pumps could simulate stresses encountered by man during launch and re-entry. Visual position (darker) is of Convair's proposed space chamber on testing one new vehicle.



SCALE MODEL of 85' diameter tracking antenna, now under construction. Reflector face surface is fabricated from aluminum. Pedestal, Polar Cage, Declination Cage and lead-in structure are of galvanized steel. Scale: 3/4" = 1'



## New Blaw-Knox 85' Diameter Tracking Antenna

This newest Blaw-Knox 85' Diameter Tracking Antenna will be part of a teletracking operation connected with missile and satellite development.

In design is fully demonstrative. All structural members of the assembly are analyzed for stress and deflection before fabrication. Coupled with shop fabrication and field erection to rigidly accurate tolerances, it is capable of the highest gain, with a minimum of distortion or aberrations.

The entire drive system embraces such critical design requirements as relatively variable movement with negligible creep or overrun for tracking. The driving drives are capable of the extremely slow acceleration and deceleration necessary to focus on asymptotic targets.

Processing like this is the latest step in a long series of Blaw-Knox developments. Such milestones as the

Guyed Vertical Radiator design in AM radio, the first radar antenna used to bounce signals off the moon, and the Tropospheric Scatter Antenna for over-the-horizon television have marked Blaw-Knox as a world leader in advanced design, fabrication and erection techniques.

Blaw-Knox welcomes the opportunity to translate your most advanced concepts into highly reliable operating equipment. Contact the Antenna Group.

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**BLAW-KNOX COMPANY**  
Blaw-Knox Equipment Division  
Pittsburgh 25, Pennsylvania

man and instrument would include, using launch and receiver systems, including, ranging or tracking, detection, noise limit and amplification, these would be handled with electronics, often on three or four panels, a chassis under the test tape recording, leaving clearance at sides with, and vacuum lines and gauges.

Most of the space stories except the neighborhood and sensor radiation, would include heat, cold, noise, shock, hypoxia, darkness, confinement and low oxygen supply, infinite heat sink, solar radiation—which could be simulated by an artificial "sun" and air conditioner—humidifier, vacuum pump and heat, oxygen, insulated and refrigerated blankets with. Some separate simulation of neighborhood could be obtained by water submersion as has been done in test aircraft.

Equipment required to simulate the environmental conditions could be installed in and around the small sealed chamber, at particular location on the wall of the chamber where they would accurately reproduce the desired effects such as "sun" lighting the "space chamber" nearby would permit such transmission of the sealed cabin to the space chamber without interruption of testing except to cut vent and disconnect pump and lines, leaving subject still in sealed cabin.

In principle, the use of ability of ground testing, Dr. Whitlock and

- Procedures and suggested flight testing, with safety and economy.
- Includes combined environmental changes to be considered.
- Tests the integrated system.
- Long term study of facilities is enhanced for modification of equipment and use in selection and training of test crew.

Five principles evolved the flight testing, Dr. Whitlock declared are:

- Instrumented and manual flight possible with.
- Man in complete out of the control loop in first flight.
- Thorough pre ground testing.
- Acquisition by flight testing.
- Finding the unknown in increments.

## Sperry Manufactures Jupiter Guidance

Local guidance for Avon's Jupiter intermediate range ballistic missile is being produced by Sperry Gyro Corp. as well as by its sister Sperry Rand Division, Ford Instrument Sperry Gyro, which is producing about one-third of the units, reports that after five months under contract it is "about of scheduled," has delivered 50% of an initial commitment, has remaining 20% to test.

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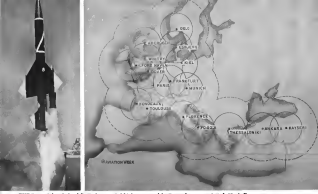
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BAUSCH & LOMB





MAP shows where 24 Boeing Borsac area defense missile weapon systems also are located in 17 states in the United States.



24 Boeing Borsac area defense missile weapon systems also are located in 17 states in the United States.

## Boeing Proposes Bomarc Missile to NATO Nations as Area Defense Weapon System

By David A. Anderson

General-Bearing Aerospace Co. is making a strong bid to sell its Bomarc area-defense weapon system to European countries within the NATO framework.

Military leaders from France, Germany and Sweden have already been briefed completely on the missile at Boeing's public information division in Seattle. Unofficial discussions of system capabilities are being made at various levels of the NATO structure.

Company is specifically selling its improved Bomarc IM-99B or Super Bomarc, designed to strike targets at least 400 mi. from its base. Current production Bomarc were designed for a 300-mi. operational radius.

Boeing's 15 Super Bomarc batteries located behind the existing NATO perimeter could provide area defense for the entire sector of countries from Norway to Italy and from West Germany to Portugal. Such a system would be tied in to an early warning air warning link and use the Westinghouse AN/CWP-15 weapons control. Bomarc's inferring system with USAF's Air Defense Command will be linked into

the SAGE ground measurement system.

Company executives are telling Bomarc at the most delicate for the last time. Boeing points out that it does not eliminate the need for point defense missile systems such as the Nike Ajax units now being built in Germany, Belgium and the Netherlands. But Boeing emphasizes that its divided Bomarc would not a fraction of the money needed for a Command fighter, that size and personnel requirements are of a minimum.

### Bomarc's Advantages

Four major advantages are claimed for the supersonic, man-powered Bomarc:

- **Maneuvering firepower**, which means that one number of rounds up to 25 can be fired against one target.
- **High altitude**, which means that one number of rounds up to 25 can be fired against one target.
- **High altitude**, which means that one number of rounds up to 25 can be fired against one target.

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intercept simultaneously. Ground computers can send parallel intercept problems, and data to a number of systems, making effect to frequency-domain or time-domain data link.

- **Low altitude**, which is provided by the radar capability of the missile. Bomarc can track, collect, and destroy high explosive or nuclear warheads depending on expected threat.
- **Flexibility**, which provides operational capability including single multi-target intercept of various altitudes or accuracies; flight, multiple and separate intercepts against one target; and one or more from several bearings, and multiple lifts resulting from single tracking data in the middle of a second target.

Basic concept of Bomarc led to the selection of its unusual layout with a composite propellant of nuclear boiler and jet engine. Original requirements were for a long range, maneuverable, which required two things: conventional supersonic speed and ability to maneuver at supersonic speeds with out an appreciable velocity error. Bomarc's gas turbine could provide the cruise performance needed and at the same time, supply continuous thrust

over the entire flight path required to make the missile highly maneuverable on a combination of lift and thrust. So Bomarc evolved as a variable engine, mounted by a rocket engine and powered in cruise flight by a jet engine. Like an airplane, it banks in turning flight, instead of sliding at the most maneuvering supersonic speeds.

Currently there are two different Bomarc under active development:

- **Bomarc IM-99A**, the first production missile, with an operational radius of 200 mi. The launcher is an Aerojet-General liquid propellant rocket and the sustainer is a pair of Marquardt RH-59A-1 engines. Design speed is about Mach 3.5 at a cruise altitude about 60,000 ft.

- **Super Bomarc IM-99B** is an advanced version with an operational radius of better than 400 mi. Launcher is a Thiokol solid-propellant rocket and the sustainer is a pair of improved Marquardt RH-59A-1 engines similar to those of IM-99A. Design speed has been estimated at close to Mach 4 at altitudes around 100,000 ft.

Both missiles would be stored in total in external magazines and their

ground environment and support equipment would be almost completely common to both. Super Bomarc could be delivered to European bases and with a minimum effort effective coverage of a base would be guaranteed in one.

### Research Program

Boeing also has a major missile research program under way in an anti-missile application, but this is not to be confused with a stretched Bomarc or an extension of Bomarc techniques. Complexity of the problem and technological advances in the next few years will dictate a completely different approach.

Boeing has a solid agreement to have its own pilots select the Bomarc in the area defense missile for the North American continent. Fourteen Bomarc have been built and are currently in use by the USAF, with construction beginning on four located in the East Coast between Maine and New Jersey. About \$105 million has been approved for line construction.

As prime contractor for the entire missile system, including command ground environment and support equip-

ment, Boeing is responsible for overall design of Bomarc defense scheme. The company holds operational contracts for several hundred million dollars for production rounds and associated ground support equipment.

USAF has activated the last Bomarc squadron code in 47th Air Defense Missile Wing, 73rd Air Division, Tyndall AFB, Fla. Officers from the wing are now completing a continuous retraining course at Boeing, will shortly transfer to King Air at Air Force Missile Test Center, Cape Canaveral. Next assignment will take them to an operational training base now being built on Santa Rosa Island in the Gulf near Eglin AFB, Fla. Final assignment will be at a completed Bomarc site at one of the bases now under construction.

The key structures in a Bomarc site are missile ducts, one for each of 24 missiles, and reinforced concrete building with a vertical flight strength building, maintenance. These ducts will be the center after its final off-site assembly and moving and from there on into the field in a state of readiness.

Each base is linked through communications network, to weapon control center. These multiple duplex paths





# Holley engine controls selected for JT4 engines on America's first jet airliner



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Powered by four JT4 Pratt & Whitney Aircraft engines, the Boeing 707-320 will carry 131 first class passengers from New York non-stop to the Continent in just over an hour! Each of these new engines, commercial counterparts to the J-75 which drives many of America's latest jet fighters, delivers up to 15,000 pounds of thrust. Ability to pack so much added power into a relatively small space is the result of designing engine components which will operate at higher efficiency, require less area and reduce over-all weight.

Holley Carburetor Company, work-

ing closely with Pratt & Whitney Aircraft engineers, carried out this exacting assignment on such vital engine components as the compressor bleed governor, and the bleed

governor actuator. For single and multi-engine military aircraft, the Holley main fuel control is a comparison unit to the Holley governor and actuator.



For military applications, the Holley main fuel control (right) is a comparison unit to the governor and actuator.



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Much 595 at altitudes above 100,000 ft. This kind of performance indicates the substitution of a carburetor carburetor delivery unit for the single-injected check-type used on RJ45 MX-3 engines. Manually in working on jet engines with such an inlet.

That's it also the possibility that Super Boreas will have "up" back into its cargo engine.

Along with development and production of the Boreas, Boeing has taken over profile work in flight testing and training.

Flight tests of IM-99A Boreas should be completed by now at the Air Force Missile Test Center. Future firing of production models now being delivered will be the responsibility of a USAF operational training unit to be stationed at Santa Rosa Island. Since September 1957, when the first Boreas prototype vehicle left off its stand to mark the beginning of flight tests, Boeing has launched 19 complete models. Last rounds in progress were conducted with all operational equipment. Next phase of Boreas work at Cape Canaveral will be firing of Super Boreas IM-99B. Program is expected to cover up to 40 rounds and to take several years to complete.

Guidance system flight tests began on converted Martin B-57 modified by Texas Aircraft Corp. to take the full 17 ft. of the Boreas nose and fuselage. This long-nosed B-57 was used to test interceptors as a Lockheed T-33 trained target to check accuracy and accuracy of Boreas homing system.

Now being completed at Huelo Island near Seattle, is the insulated Boreas line to be used for future training of Air Force missile technicians. Operating for last two years as a training school, Huelo Island was converted along the lines of a standard Boreas base, including near prototype shelter. Only difference is that the Huelo Island shelter has a full complement of Boreas to be used in firing practice with no need to open and seal and repair stations and instructors in Washington weather.

## Boreas History

Boreas started work on an aircraft carrier with its GAFA-guided to an offshore aircraft-carrier at the end of the war. Project entered phase two program in January, 1946, with funding to cover building experimental flight school and standard concept engine. First engine followed immediately, and before termination of program in 1949, Boeing test team had launched 212 vehicles of all shapes and sizes.

GAFA was cancelled on a black day in 1949, the test was suspended during a meeting in Seattle of the Boreas Project working group. Decision



## British Start Long Range Missile Tests

Testing of various components of British long range ballistic missile in under way at Hatfield, England. Missile will carry nuclear warhead, is 18 ft. in diameter and is about 75 ft. long. Rocket motor test will be undertaken at Spentish, Wren, Co. Durham, being built at Woomers, Australia. Dr. Harold Proffitt, Ltd., is prime contractor.

most out of the deal between Air Force and Army, even with overall mission. GAFA was short-range weapon and was far from an operational hardware unit. In 1946, Army Ordnance got responsibility for such assets.

With GAFA dead, Boeing quickly proposed to Air Force an advanced weapon with increased range and complete ground support system. USAF is now proud that along to the University of Michigan, where an air defense system called Warden was being studied at the time. New project became a joint effort, with the name Boreas taking its first two letters from Boeing and the last four from Michigan Association Research Center.

The first prototype Boreas vehicle without its rocket engine flew Sept. 13, 1952. It resembled greatly the last vehicle in GAFA program. First test at present Boreas flew successfully Feb. 24, 1955.

The last production IM-99A model

was delivered to USAF last Dec. 30 and subsequent production models are following in rapid buildup. Work of Hughes Aircraft Division is being featured in missile production center in Seattle and will be completed by January. Peak employment of 5,000 persons is expected by mid-1956 as Boreas program.

## Diversy Engineering Buys Huntsville Plant

Diversy Engineering Co., Franklin Park, Ill., graded missile component manufacturing has purchased the plant equipment and assets of the Wauson Tool & Engineering Co., Huntsville, Ala. Wauson will become the Huntsville Division of Diversy Engineering Co. Division will be expanded into the new Huntsville Industrial Sec. Area, and an additional 40,000 sq. ft. has been purchased for the expansion.

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## AVIONICS



TEST SETUP for studying amplifying properties of a nonlinear capacitor semiconductor diode is at left. Signal diode and rectifier are being inserted into test fixture. Pump frequency of 12,000 mc. enters from left while 6,000 mc. signal frequency enters at right, is amplified and reflected back through waveguide. UHF traveling wave amplifier employing four signal diodes is at right.

## Diode Amplifier Has Low Noise Potential

By James A. Ficca

Murray Hill, N. J.—New type of variable reactance amplifier which uses semiconductor diodes as the active elements offers advantages of extremely low noise, simplicity, long life and low cost. Capable of operating over a broad range of frequencies and providing extremely large bandwidths, devices appear to provide significant improvements in applications ranging from commercial television receivers to automatic radar.

Low noise characteristics of the amplifier can be gained at room temperature. No refrigeration or magnetic fields are necessary. Direct development at the Bell Telephone Laboratories.

As with other types of variable or reactance amplifiers, applied voltage is derived from a high frequency pump signal. With this technique, the pump signal voltage is applied to a variable reactance diode (varactor diode) causing it to function as a time varying capacitance and supplying the energy to produce amplification.

### Low Noise Amplifiers

Because the device operates on the principle of varying one parameter of a circuit, it falls in the category of "passive amplifiers" along with ferrite, varactor, and other amplifiers which depend upon

varying reactance. A separate hot cathode triode signal circuit is, pass amplifier amplifiers' one form of noise.

Comparison of amplifier characteristics obtained thus far in the development phase with present devices for low noise applications indicates the potential usefulness of the Bell technique. At 100 mc. a 4900 signal diode will provide about 25 db gain with a bandwidth of 7 mc. and a noise figure of 1.5 db. At the frequency, the semiconductor amplifier provides 10 db gain with a bandwidth of 100 mc. and a noise figure of 1.5 db.

At 5,000 mc. the best traveling wave tubes will provide about 10 db gain with a bandwidth of 700 mc. and a noise figure of 1.5 db while the semiconductor amplifier will provide 12 db gain with a bandwidth of 8 mc. and a noise figure of 1.5 db for the single side band amplification, 2.5 db for double sideband.

A related type of parametric amplifier has been announced by Radio Corp. of America (RCA) [ENR July 14, p. 88] which employs a germanium diode and a pump signal but differs in that the pump signal is at a lower frequency than the signal to be amplified. Bell device uses a higher frequency pump signal.

Amplifier consists of the diode circuit connected to a waveguide or coaxial line

which is a source for the pump signal. Incoming signal is inserted into the circuit and received through a modulator which isolates input from output in the cavity the signal is amplified through mixing with the pump signal in both signals are amplified on the non-linear capacitive reactance of the diode.

### Capacity Effect

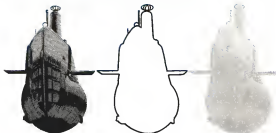
Although the variable capacity effect is present in commercial semiconductor diodes, Bell scientists have developed a special diffusion technique to maximize the effect. Because thermal resistance is a potential source of noise, these diodes minimize resistance through a graded diffusion technique. Active diode is made about 0.002 in.

When the two signals are impressed on the diode, a wide spectrum of nonlinear products is produced. The two low cut sidebands appear at the use and differentiate frequencies of the signals and mix these sidebands are of significance.

The amount of gain obtainable is less and only by the properties of the circuit and often a constant gain bandwidth product scheme. Gain in this type of device can be considered as a negative reactance effect.

A single diode can be used to provide amplification at one desired frequency but the high capacitance requires a d.c. bias. Noise performance of this type of ampli-

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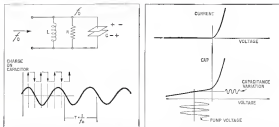
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**PROCESS OF AMPLIFICATION** through introduction of signal and pumping frequencies can be demonstrated by mechanical analogy at left. If a slowly oscillating signal is applied and capacitor plates pulled apart at maximum charge and moved together at maximum charge, mechanical pumping action will cause amplification of the signal. Drawing at right compares current-voltage relationship of conventional p-n diode with capacity-voltage relationship in pumping signal is applied.

for impedance at the frequency decreases into the UHF region.

In a typical amplifier of this type, the semiconductor diode is connected at the junction of two waveguides. A pump signal of 12,000 mc is impressed upon the diode through one waveguide while the 5,000 mc signal is inserted through the other waveguide.

#### More Signal Power

Amplification is obtained by enhancing more signal power into the signal waveguide than was inserted.

A circulator is used to provide isolation between the incoming and out-

going waves, and to prevent thermal noise in the load from being amplified.

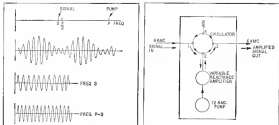
Gain of the amplifier depends on the pumping power level as well as on the current adjustment. Requirement for the pumping source is that it produce a variable voltage swing across the nonlinear capacitance of the diode. Therefore, a diode with a high static capacitance will require more pump power than one with a lower value, and a circuit with a high Q for the pump will be more efficient than a low Q circuit.

A traveling wave amplifier configuration, employing arrays of several diodes, has produced bandwidths as wide as

25% of the modified frequency in the UHF region. By using four stages with the special diodes in such an array, Bell scientists have obtained a bandwidth of 100 mc at a 400 mc signal frequency, with a pump frequency of 900 mc and a pump power of 10 mw. Amplifier had a gain of 10 db and a noise figure of 3.5 db.

#### Pumping Action

Process of amplification through the introduction of a pumping signal can be compared with the following physical analogy. If a slowly oscillating signal were applied to a simple mechanical



**DRAWING** at left shows modulation of amplified signal output of the variable reactance amplifier that results from interaction of the signal frequency with the other (difference) frequency. Sketch at right indicates path of the input signal through the circulator and to output input loss output.



## NAVTAC: "Pipeline" to a happy landing

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ment of the high performance aircraft of today and tomorrow. Its operating ambient temperature range is -60 to +130 degrees C at altitudes up to 30,000 feet. Withstand time of semiconductor in the ILS receivers and TACAN counter means high reliability, small size and low power consumption.

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ent, alternating positive and negative charges would build up on the plates of the capacitor.

If a mechanical pumping action could be applied to the plates of the capacitor in phase with the applied signal—first in, if the plates of the capacitor could be pulled apart quickly at the instant of maximum charge and pushed close to gather quickly at the instant of zero charge—the mechanical work of pumping would cause the applied signal to be amplified.

## Output Power

In the semiconductor amplifier, output power is divided between the amplified signal and the modulation products.

Most important of these products is the difference frequency between the pump and signal frequencies. Because of the power output in this sub-band, difference frequency must be selected to be outside of the bandwidth of interest.

Because the difference frequency consumes power without contributing to the operation of the amplifier, it is termed the "leak" frequency. Because of the generation of heat and other waste frequencies during the process of amplification, noise performance of the amplifier should be better for use with a double sub-band centered cascade at one half the pump signal frequency, with coherent signal and other frequencies, than with a signal having the same total power but with no leakage about the cascade pump frequency point.

On an experimental basis, amplifier noise figures as low as 5 db have been obtained with this special kind of double sub-band operation, corresponding to a 6 db noise figure for normal operation. However, because of the noise injected at the leak frequency, when the equivalent temperature of the input load is decreased even with minimum spectrum the added noise becomes less than that

of an ordinary amplifier having a 6 db noise figure.

Because of the nature of the amplification process, noise appears in the signal frequency band at the output due to:

- **Input noise.** Noise input at the signal frequency is amplified with the signal.
- **Leak noise.** Input noise at the leak frequency can be converted to the signal frequency in the amplification process.
- **Diode noise.** Noise originating in the diode at the signal frequency will be amplified with the signal.
- **Sum frequency noise.** Noise generated in the diode at the sum frequency

of the signal and pump frequencies will be converted to the difference frequency in the amplification process.

Most important source of noise in the diode is that originating in thermal noise in the sum circuit.

Bell scientists say that there is little doubt that better results will be developed which will make use of an internal diode to produce amplification with noise figure significantly lower than those obtained to date.

A second area requiring intensive investigation is solid state circuitry to replace conventional vacuum pumping frequency converters to achieve an all solid state amplifier.



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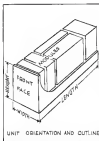
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UNIT ORIENTATION AND OUTLINE.

**NEW** Air Force exhibit standardizes dimensions of modules and chassis on which modules mount for use in future communications, weapons and identification equipment for tactical aircraft flying in the 1955-1961 period to provide greater installation flexibility (left). Facilitating of aircraft units to fuselage shape to maximize inside space is discussed in the Air Force exhibit (right).

## USAF Avionics to Use Standard Modules

By Philip J. Klein

Washington-Aircraft design criteria for Air Force communications, navigation and identification equipment for use in tactical aircraft in the 1955-1961 period have been revised by Wright Air Development Center's Communications and Navigation Lab recently.

New exhibit WCLN-5515 adopts small standard building-block concept and dimensions developed by New Bureau of Aeronautics in its MIL-E-15600 (Av). This exhibit replaces recently issued MIL-U-2590 (USAF) which was withdrawn when Air Research & Development Command Headquarters decided that further coordination with other ARDC centers and laboratories was needed before design criteria could be issued as an Air Force specification.

New standard concept and dimensions should enable:

- Air Force to study and quickly accept equipment required for use in new aircraft without major component redesign now required.
- Aircraft manufacturers to have fit avionics equipment into aircraft configuration with greater efficiency, less weight space.
- Avionics manufacturers to use standardized module dimensions for many Air Force and Navy airborne equipment permitting greater interchangeability of Air Force and Navy development.

Until several years ago, it was possible to use single standardized design of communications, navigation and/or identification equipment on a variety of different aircraft. Today most avionics equipment must be tailored to the fuselage configuration of each individual airplane to use available space effectively.

### Rampage Problem

Even in such basic devices as communications sets, common to all Air Force aircraft, the problem has gotten out of hand. For example despite the fact that the Air Force has three basic UHF communications sets in its inventory (ARC-11, ARC-13, ARC-14), each with a different form factor, none of them were suitable for use in new services such as the F-105, B-55 and F-105. As a result, it was necessary to develop or acquire for new UHF sets, each to meet requirements of a different airplane.

This has proven costly in terms of money and engineering time and compounds Air Force logistic support problem, surface applicability, improving the state of communications, according to John C. Wrighton (Wrighton is chief, integration section, Communications and Navigation Laboratory).

Through use of new standardized modules, WADC expects to be able to rapidly adapt an equipment to aircraft aircraft are desired from before.

In addition to standardizing mod-

ule dimensions, new specification also standardizes crane dimensions of the "unit" chassis on which a group of modules is mounted.

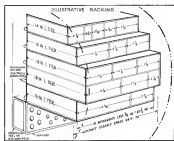
New exhibit represents a sharp reversal from an earlier attempt to derive a standard design criteria. Under WADC contract, Radio Corp. of America aimed major aircraft and avionics manufacturers in 1955 to show that even on preferred module dimensions, cranking positions and vibration isolation. But at this time, no ascending functional modules whose dimensions were considerably larger than Radio's MIL-E-15600, were presented at a WADC meeting last summer to representatives of defense and avionics industry.

Although many avionics manufacturer are opposed saying, if not correct, to go along with RCA's recommendations, the avionics industry has objected vociferously, because larger module dimensions would result in poor avionics space utilization.

As a result of this meeting, WADC and RCA decided to take a fresh look at the problem, and the new exhibit is the result. Wrighton hereby credits Radio with having "pioneered" the new USAF module concept in its MIL-E-15600. Air Force will incorporate MIL-E-15600 module dimensions with a few additional changes.

Exhibit still call for expression to work, to the following dimensions in designing modules for avionics aircraft:

- Height: 11 in. (fixed, not maximum)



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Individual modules can be located and positioned in one convenient manner in "nest" channels in order to achieve optimum packaging density. Standard unit dimensions for each "nest", called out in Air Force specification, include:

• Height: 65 in. (allows 2 in. high base for fixed or rotating plume channels)

• Width: 24, 34 1/16, 44, 74, 104, 134 in. (width dimensions are multiples of 1-5/16 in.)

• Length: This dimension, determined by required installation, should be established first. This in turn will determine required width of nest. When specific surface usage is not known, designer should use length of 34, 44 or 74 in.

Specification makes no attempt to standardize airflow and design, leaving this to the individual aircraft manufacturer, except that it must be able to accept units with new standard dimensions.

For ease of interchangeability, special features are no controls, test points, meters or other external functions can be located on front panel of nest. They should be mounted inside the "nest" closure and a fixed panel cannot provide too access or look through.

Main points of some other questions



### Auto-Landing Reflector

Kaiser steel section of Bearing 207 is in cross by a laser effect mounted on landing gear for recent tests of Bell Aircraft Corp.'s automatic auto-landing system (AFLS) for the F-105. In tests, system landed jet without pilot landing controls

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mounting is used to secure wiring to test surface and connections. Cables are electrically insulated from test structure. Units measure 0.75 x 1.25 x 1.51 in. (Aerotec Corp., 361 E. California St., Pasadena, California).



• **Lightweight** moving coil indicators, Model MIEP 7, is for use with aircraft instruments coupling flap or alarm indicators with short deflection angle. Unit uses an integrated mechanism with internal gears, high torque, and a divided magnet. Internal magnet design makes compass reference negligible. Skunk Works Instrument Co., Greenvale, Maryland, N.Y.



• **5-band duplex** Type BL-554, is used primarily for connecting two transmitters operating at different frequencies to a common antenna feed with low cross talk. That also separates two channels at separate frequencies into the appropriate receiver channels. Two all-glass plug-ins provides continuous rotation of the two duplexing frequencies. Replaceable sections makes possible duplicating of wave combinations of frequencies. Bessac Laboratories, Inc., Silver Hill, Beverly, Mass.

• **RF power divider** covering the frequency ranges of 300-100 and 200-600 mc, are to connect a 75 ohm source to 250 loads. Each divider contains a low loss matching transformer section to minimize losses, insertions. Input loss is less than 1.75 db and loss about 3 db. Power rating is 500 w at 1500 ohms. Special units are available for

other frequency bands and for power levels to 100 kw, and for lower loss. Adams Research Co., Inc., 202 Main St., Cambridge, Mass.

• **Thermal gas analyzer** scans provides impedance transformation while containing 20 db of gain. Units have been developed for use with high impedance sources such as accelerometers and hydrophones. Input impedance is one megohm, output impedance 600 ohms, operating input noise 10 microvolts. Frequency response 100 to 50,000



cps. Units can be powered from an internal Mercury battery, or external supply. Low level or remote control. Models with higher input impedances also are available. Chesapeake Instrument Corp., Sludville, Md.

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Rite the B-55 into service. Consideration of effort also cuts into because three test efforts are needed when the program is conducted in one phase. This advantage cannot be changed for the B-55 because it was selected to test quickly before the new system was defined.

Another spur to the switch to testing technique was the fact that missiles do not adapt to the stress of phase testing at various centers. The realities of missile testing force USAF to concentrate missile test programs at a single site, and the readiness and openness of the missile test center at Cape Canaveral, Fla., was a harbinger of the adoption of combined category testing for all weapon classes.

For the contractor, there is little new in the types of test work and training at onset do, but the timing is changed considerably. Canaveral's assistant manager of customer service, G. S. Green points out that the telescoped, consolidated program will keep the company clear to the B-55 during the entire development period. And Canaveral will have a close-up view of the Mach 2 bomber in an operational environment when Strategic Air Command takes over the program.

Staying close to the B-55 will help Canaveral work out bugs and make changes in the production version before the upgrade goes into service. It also helps Canaveral keep its vibration facilities close to the test program.

The B-55 program was the first to operate under the new concept, but when have begun to move in the new direction. Testing of the B-55 started under the old phase system, and Phases I and II had been completed when the switch to category testing was made. While Category I work is still going on, the program has now moved into the early stages of Category II.

To complete B-55 testing under the category plan, Canaveral ARDC and Strategic Air Command will work together with other test base members in a program at Canaveral AFB.

Choice of Canaveral deviates from the standard pattern of using ARDC centers to host test programs, but it has the advantages of being next door to the Canaveral's Work plant and being an operational SAC base.

Test force running the B-55 program began forming around the first of the year. Since then, there have been a series of policy letters which drew in the test base side although the group was formed without a detailed regulation from the Pentagon. The new concept actually reveals a result of Air Force Regulation 584.

Canaveral Test Force is composed of the 692nd Test Squadron (B-55) from ARDC, commanded by Col David M. Jones and SAC's 9918th Operational

Evaluation and Training Squadron under Col Richard F. Evans. Since the program is in Category II, Col Jones runs the show in test director with Evans and Col J. H. Melton of ARDC as deputy assistants. When the program moves into Category III and SAC takes responsibility, Col Evans will take over as test director.

Canaveral is assigned directly to ARDC Headquarters and Col Evans is assigned to the director of operations at SAC Headquarters, as well as command air staff and chief in top levels.

Canaveral Air Materiel Command and Air Training Command personnel are also assigned to the Test Force. In the operating element, the team also submerges the flexibility of the SAC and ARDC equipment and man power personnel from both organizations together in operating groups.

Test Force has now set up its preferences and recommendations and has formulated its test plan and an open house plan. Its first B-55 has been received from Canaveral and is now in the cold hangar at Eglin AFB, Fla., for climatic and cold weather testing. More airplanes are scheduled to be delivered to the Test Force out of the 30 ordered for test purposes, and Canaveral and the Test Force will each operate a pool of B-55s.

Canaveral strength of the Test Force is 240, and further buildup is planned will be commensurate with the scope of work assigned. Most ARDC personnel assigned to the program already are at Canaveral, and with the buildup, which will extend over 15 months, SAC personnel will increase its numbers until they make up the bulk of the group at the fall of 1974. While ARDC is still running Category II, SAC pilots and crews will be checking the B-55, and flying also for the Category III program.

Programs already contracted for by Canaveral under the old phase testing programs are closely controlled by the test group as a work's duplicate efforts. A mutual exchange of information between Canaveral and the group provides test results and experience on which the task force is building its program.

Certain jobs which center to be done by the group at Canaveral will be focused into test centers at Eglin AFB. But test AFB and Canaveral. These centers will reflect and their experts in Canaveral or will be assigned a B-55. But the main test functions remain at Canaveral, and all reports to the weapon system project office, including those for work turned out, are written at Canaveral.

Last November, Canaveral set up a customer service department under J. T. Cady, the B-55 program director. It was designed to provide response expertise before and after delivery of the

bomber to SAC. This department can be used to update under the new concept and the customer manager of the department, G. S. Green, is top Canaveral man in the test base.

Canaveral has started its training job on the B-55 with the establishment of a ground school. Two classes each of flight and ground personnel have gone through the ground course to the computer on its new weapon system.

By mid-July, about a dozen pilots had been trained and more were scheduled to start through the school. The pilots trained in ground school have not all been checked out in the airplane. In this part of the cycle, the

training is closely for ARDC, emphasizing test pilots, but SAC pilots will start going through in the fall. SAC crew members, men who will support the program begin a detailed requirements and operations course in August.

Mobile training units and flight simulators will have their part in the training program. Canaveral is now building a unit which will include 17 training rigs and 16 different pods to duplicate the workings of the B-55 and its systems. Simulators are scheduled to be introduced into the program about the time the first B-55 is delivered.

Flight simulators will have a more important role in the B-55 program

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then they have had no previous bomber programs because of the fact that the airplane has only one pilot. Since there will be no clock pilot along on the first flight, ground training assumes increased importance, and B-58 pilots will probably be more highly qualified for their first flight than pilots on previous bomber types. Convair and USAF expect no difficulties; then the pilots report the B-58 follows predicted characteristics very closely, and is a "very forgiving airplane."

From its early B-58 flight experience, Convair decided the TF-102 had a place in training for the B-58, basically for training pilots in the flight characteristics of delta-wing aircraft. Test Force is checking the idea out and the TF-102 probably will be used in the program for transition training.

## Rolls-Royce RA-29 Overhaul Life Raised

London—Bentley Air Registration Board has authorized overhaul life of 1,000 hr. for Rolls-Royce Avon RA-29. The Harland County 4 and Sud Aviation Cirécou are powered with the 10,500 lb. thrust engines. Airframe is given tests started in September, 1957, when two Convair 32 aircraft, powered by two RA-29s and two earlier Avon made first scheduled flight tests. Landing in Beirut and back, in seventh air historical 14 hr. per day. This also involved 1,600 hr. flying time on the engines. Due to failure of another unit, one RA-29 was removed from service. Engines were stripped and examined by the Air Registration Board at 210, 500, 750 and 1,000 hr. After 1,000 hr. the compressor case showed no evidence of distortion and only slight traces of hard enamel coating. The case are being re-used and are expected to give a further life without inspection of at least 750 hr. Work was due to being done because of the flying type of one location according to Rolls-Royce. A large percentage of the parts required were non-metallic, mostly consisting of seals and gaskets. Metallic parts included stainless steel pipes, pipe clips and fuel can necks against distortion. Rolls-Royce said Rebuilding was found to be sound and will be re-used. Rolls-Royce spokesman told Aviation Week that they were confident of a 5,000 hr. life for the turbine blades and disks. Convair pointed out that it had equipped disks of the Dart engine for per cent "in excess of 5,000 hr."

Engines were operated at a turbine inlet air temperature of 1,015°C and a cruising thrust of 5,810 lb. Fuel consumption was 571.8 lb. per hr. thrust per hr. Reduction in thrust at the end of the setting was less than 210, the company said.

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Clear air turbulence is caused by turbulent eddies in regions of weak subsidence, that is, wherever wind velocities (speed and direction) vary sharply over short distances. It is

generally associated with the tropopause and edges of the jet stream. Guidance is not given for flight. Here and there clouds in or near flight level. Rapid temperature changes. Fluctuations of wind speed and direction. All can indicate approaching turbulence. What to do when turbulence is encountered. Reduce speed. That may reduce severity of jolting. Change altitude. Change direction. All turbulence cases, then means heading.



Altitude-scales Altitude-scales with jet stream. Clear air turbulence is encountered above these clouds in clear air.

Photograph courtesy, Kennedy Foundation, Panama Park Research in Heliograph

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## BUSINESS FLYING



Sikorsky will send its first S-62 on a demonstration tour of the U.S. and Canada this fall. Second S-62 will be used for type test and military evaluation. Decision has been made to build a third S-62 for engineering development projects and CAA testing.

## Race for Turbine Helicopter Sales Starts

Commercial sales efforts for the first U.S. designed turbine helicopter are under way, with three developments.

•Bell Helicopter Corp. officials met with Civil Aeronautics Administration to plan certification of the Bell HU-1, designated Model 204 in its commercial version. Army YH-40, a service test version of the HU-1, was used for CAA demonstration demonstrations.

•Sikorsky Aircraft Division of United Aircraft Corp. removed test equipment and began construction of its first S-62 for a demonstration tour of the U.S. and Canada this fall. The second S-62, which is now under construction at Sikorsky's Bridgeport plant, will be used

for type test and military evaluation. The third S-62, which Sikorsky has not decided to build, will be used for engineering development projects and CAA testing.

•Vestair Aircraft Corp. spokesman said that the T33 powered T07 would be available to commercial operators in 1961. Thus far no certification work has been arranged with CAA. Test version, model of the T07, the T33-4, have been ordered by the U.S. Army with first delivery expected in approximately eight months.

CAA can complete the certification process in six to nine months. Bell is not ready yet to take commercial orders for the HU-1, but will make the

helicopter available as soon as military production permits.

Results of company test programs can be obtained in meeting CAA test requirements. Sikorsky, for example, has begun a complete program of rough water tests for the amphibious S-62.

Initial results, on a Force 1-3 test in Long Island Sound (waves 5 ft. high) were good, the company said. The ship remained dry and stable, the company said, the tail rotor remained clear of water and no water entered the intake of the General Electric T38 engine. Landings were automatic into a 14-18 kt. wind, resulting in a touchdown speed of 104.7 kt.

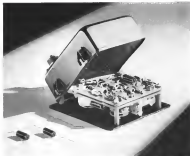
The S-62 will be demonstrated at



Bell plans Civil Aeronautics Administration certification of its HU-1, designated Model 204 in its commercial version, YH-40 (above), service test version of HU-1, was used in CAA demonstration.



# Airborne Miniaturized Mylar® Capacitors help reduce weight and bulk in electronic packages



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Developed originally for motor start and run purposes, Airborne miniaturized Mylar capacitors are currently finding increasing application in electronic devices where small size, light weight and high reliability are of paramount importance.

Typical of such applications is one of our own servo control amplifiers shown above. Used as a component of an Airborne-designed or Airborne-controlled system for high performance aircraft, the amplifier consists of a 1% precision resistance bridge, stable feedback, transistor amplifier, reference oscillator, phase discriminator, and relay output amplifier. Production units employ printed circuitry.

Two of Airborne's miniaturized

"Mylar" capacitors are utilized in this particular amplifier — a 1 microfarad for timing in the reference oscillator section of the amplifier and a .02 microfarad for phase shift correction in the stable feedback transistor amplifier section. Capacitors are epoxy sealed and are designed to meet or exceed Government specifications MIL-C-25A.

Wood of this miniaturized "Mylar" film, Airborne miniaturized capacitors are rated up to 600 v d.c., 350 v a-c and have an operating temperature range of -75 to +300°F. At 300°F they will withstand 120% rated voltage for 350 hr.

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ties. Inquiries are also invited to complete electro-mechanical control systems.

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Toronto, Ottawa and Montreal for civil and military applications Sept. 4-12. It will go to Philadelphia Sept. 14 for demonstrations at a state military utility symposium and later to the South for a two or three week tour at military bases.

Bell uses the Licensing TSS turbine powerplant. This is currently in process of certification at Kerosene's Montreal, Que., plant. A batch of six Y10-40 helicopters is currently being delivered to the U.S. Army for testing. Last of the six will be delivered late in August. Production model, the Y10-40 will start coming off the line this fall.

Of the six Y models, one will remain with Bell at Bell's Bellville, N.J. plant. One Y10-40 is at Egna Air Base for civilian and military testing, one is at Edwards AFB for Air Force testing and one is at Yuma, Ariz. for desert tests. The Yuma ship will go to Bell's Bellville plant and the remaining two Y models will be scheduled for Bell's Bellville.

The six-ship helicopter has a climb rate in excess of 2,000 ft per minute, a turn rate of more than 600 deg and a cruise speed of 115 mph.

Most of the changes between X and Y models are related to project captain Jack Reyer.

Cabin has been lengthened 12 in. giving it a capacity of four litteres instead of two.

Ship has been raised four inches on its skid gear, providing more ground

clearance and more over maintenance. • Change in engine air inlet ducts greatly improved engine performance. • Top cowling has been strengthened, increasing engine air intake system. • Y model has hydraulically operated ground handling wheels instead of casters operated wheels. • A low-static stabilizing bar has been installed on top of the rotor, increasing stability.

• Two seats on top of the forward rotor hub improve engine ventilation.

• Stick-braking or artificial feel with have been changed from hydraulically operated units to magnetic brake units, improving the pilot's control feel.

• A compressor which mechanically ties the collective pitch system into the engine governor device has been installed. This maintains engine speed constant with changes in collective pitch.

• Crew door has been widened four inches for easier entrance.

• Licensing TSS turbine engine, which is rated at 560 shp, is derated to 770 shp on the Y model. It was derated to 780 shp on the X model.

A French turbine-powered helicopter used to the civil market in the U.S. public-entertainment industry, designed by Sud Aviation. The helicopter has received FAA certification and has commercial models have been built.

A third aircraft is scheduled to be delivered next week.

## Porsche Engine Passes Tests, Enters Light Plane Market

Rotax-Porsche 675 engine is the first German aircraft powerplant to be developed since the war. The 675-hp engine of the Porsche-powered, four-cylinder engine was one of many examples of Germany's wartime development demonstrated at an air show held at Langenlois airport near Innsbruck (AW, May 16 p. 11).

The engine has completed its 150-hr British Certificate of Airworthiness test after three years of stand and flight testing.

Porsche has since sold engines to Biele Flugzeugbau, G.m.b.H., Karlsruhe, for the company's Mithras RW-1 two-seater, and to Pöschel & G., Bamberg, for the Pöschel Pöschel two-seater light plane. Pöschel is now considering using the engine to power its Mithras light plane.

Next customers on Porsche's list of prospective buyers are expected to be the Aero-Flugzeugbau Habel Zucht, Havelburg, near Magdeburg, East Germany.



PORSCHE 675-hp engine (left) has taken rating of 65 hp at 4300 rpm, costs \$2,300. Engine at right is Porsche Type 975/1, which powers Aero-Jet 411A "Chick".

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ENGINE is mounted for test in Jodel B-6 light monoplane. Cowling is attached in Pucelle Type 670/7 which weighs 135 lb. in lighter of three types in production.

Carl Hesse Nucleo, Natchez, Donau. Both firms are making Jodel lightplanes ready for use from Jodel 5 A. Donau 1 motor. Aero-Hagomphers the Aero Jodel B-11A "X" air sport plane and Jodel and Carl Hesse Nucleo the Jodel B-6 lightplane. In addition the Pucelle company says that Pucelle for south Camp, Lock Haven, Pa., has improved the engine.

Three different models are available: • Type 670/0 is a general engine with a rating of 17-1. Takeoff rating is 55 hp at 5300 rpm, maximum cruise rating is 60 hp at 4100 rpm, and most economical cruise is 48 hp at 4120 rpm. Corresponding fuel consumption are 3.5-1.1 and 4.5 gal./hr. Total weight of the engine is approximately 247 lb. and its dimensions are: length 28.05 in., width 22.09 in., height 15.79 in. Cost of this model is \$10,000 in the engine lot of \$1,150.

• Type 670/1 is a general engine with a rating of 23-1. Takeoff rating of this model is 65 hp at 4100 rpm, maximum cruise rating is 55 hp at 4100 rpm, and most economical cruise is 48 hp at 408 rpm. Corresponding fuel consumption are 5.5, 4.5 and 4.1

gal./hr. Total weight is approximately 194 lb. and the engine measures: length 25.75 in., width 21.49 in. and height 19.45 in. Cost is \$1,235. This is the model that powers the Aero-Jodel D-11A "Club" sport plane.

• Type 670/2 is a direct drive engine. Takeoff rating is 72 hp at 3200 rpm, maximum cruise rating is 50 hp at 3140 rpm and most economical cruise is 40 hp at 2970 rpm. Corresponding fuel consumption are 4.4, 4.1 and 3.2 gal./hr. Total weight is approximately 185 lb. and dimensions are: length 22.90 in., width 21.49 in. and height 19.00 in. Cost of this type is \$1,240. This engine powers the Jodel B-6 lightplane.

All three models are 90 octane fuel.

## Lockheed Subsidiary Gets AMB Contract

Contracted for \$401,510 contract covering maintenance, including major repair, servicing and repair of aircraft at National Aeronautics Facilities, Experimental Center of the Army-Vietnam Station Board at Atlantic City, N. J., has been awarded Lockheed Aircraft Service International. Contract runs July 1, 1975, to June 30, 1978.

Lockheed Aircraft Corp. subsidiaries will also handle all aircraft maintenance, installation of experimental systems and photographic services on planes assigned to AMB's program of research and development with weapons, gunnery and defense armament. Understanding the country's aviation facilities. Come still use all types of planes, piston and turbo-propelled, and jet, advanced and piston, also helicopters.



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THIRD engine in Pucelle unit is Type 670/2 rated at 52 hp at 3200 rpm



## STRAIGHT TALK TO ENGINEERS

*from Donald W. Douglas, Jr.*

*President, Douglas Aircraft Company*

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Douglas Aircraft Company, Box 620-M  
Santa Monica, California

## Southwest Airmotive to Distribute Cessna Line, Grumman Gulfstream

Dallas-Southwest Airmotive, Co. moved straight into business recently when it signed with the Cessna distributor book on distribution for the Cessna line and the Grumman Gulfstream.

Early into the aircraft sales field made a tremendous expansion for Southwest Airmotive's insurance workload and profit distribution upon two. The company will sell the Gulfstream through and will handle the Cessna line through Aircraft Sales Co., a recently acquired Ft. Worth Cessna distributor.

This expansion is more a matter of business opportunity than a deliberate determination to get new aircraft sales locations. Vice President O. Gordon Griffith told Aviation Week.

In the case of Aircraft Sales the company had an opportunity to acquire a distributor which has done an unusual business in the U.S. in the way of the jet business, but for a price in the neighborhood of \$150,000 to \$200,000. That price depends on the disposition of such factors as aircraft workload.

Southwest Airmotive feels that Cessna has an attractive line of aircraft, so the company decided to handle it Griffith said and that vice president

Airmotive management policies will be handled at Aircraft Sales but otherwise, the Cessna distributor will operate as it has in the past. Aircraft Sales will sell Cessna's 441, 440 and Longview Texas and will distribute them to dealers in Dallas, Alaska, Wichita Falls and Tulsa.

James H. Griffith has been hired by Southwest Airmotive to promote distribution and sales of aircraft. He formerly was a regional sales manager of the Texaco Oil and Refining Co.

In acquiring the Cessna sales organization, the company achieved in the sales field for the first time, in 20 years. After 20 years in business in 1956, Griffith decided that with its limited capital Southwest Airmotive would be better off dropping the Shuman line and concentrating on service. The company's capital position is considered stronger now than it was then and this is undoubtedly a primary factor in the decision to enter the sales field.

Capital was just a factor in the Gulfstream decision because Grumman is going to handle its distribution, and that will be no need to maintain or replace inventory. Southwest Airmotive will handle sales and deliveries to customers here. The company will sell the new, four-engine executive transport throughout the U.S. along with Mustang Mustang and Pacific Air service. However, Aircraft Sales of Wichita is the branch distributor.



### Low-Cost Radio

Model MK-5 for light aircraft provides 90 channel transmission and 160 channels of reception between 118-121.9 mc utilizing crystal controls and 100 3-c tuning in transmitter and receiver. Price a \$995.

Total weight including 3 1/2 lb. for transmitter and 3 1/2 lb. for receiver. Power supply is 9.5 W. and accessories are 6.5 in. wide, 5 in. deep and 12 in. long. Operating two Vh. It is to be placed on above the ether in a panel cut out only one-half inch deeper than Nava Charger. Mk. 5 can be used with Nava VNAH series receiver or CNA-1 or CNA-2 pre-mounted on receiver indicator console either to provide VNAH or HLA guidance system transmitter and receiver control is better present working and receiving on different channels.

### Cooperative Deal

Since Grumman will deliver the Gulfstream without interior or electronic gear Southwest Airmotive has arranged a cooperative deal with the U.S. Navy, to buy and install any plane for its customers. Hinton & Hinton Carbons Work Inc., Ft. Worth will provide interior and Automated Radio Inc., Dallas will install radio and electronic equipment.

Hinton & Hinton and Automated Radio will deal directly with the customer. They will do this work at Southwest Airmotive's Long Field base, with the final base, operation during the summer, airlines, work to add the Gulfstream to its fleet.

Southwest Airmotive will arrange and maintain the Rolls Royce Dart 777 engines on the Gulfstream. Since ordered from the manufacturer, powerplants is expected to be 1,500 hp, the question of medical work will come up for three years or so. In that period, it would be advisable to have the company to find up to do the job since it

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trophy has the basic tooling and test equipment. Southwest Airlines is working rubber, perfect engine and will be working them for the airlines when their jobs are fixed.

Comptroller isn't particularly concerned that its expansion into the aircraft sales might hurt sales of its parts and accessory distribution division. George W. Johnson, III, executive vice president in charge of the operation, points out that such competitive problems already existed in some degree with competing aircraft sales organizations.

## Membership Splits In OX-5 Club Ballot

OX-5 Club President Rene Brinkley issued a call to the membership to cast a heavy ballot in person or by proxy at the organization's Third National Convention at Los Angeles, Aug. 7-8 to re-elect the present constitution and elect new officers. The club being strictly a social organization.

Some members have proposed that the constitution be amended during general business sessions at the convention according to Brinkley, a founder of the club, which is composed of persons who have flown OX-5 powered aircraft. Some fear if the constitution would make possible more or more of the executives that would tend to change the character of the organization Brinkley contends. He said this could lead to the club becoming a building organization and claims that some members would be against such plans.

## Fire-Duty Alouette Withstands Hard Use

In its first 30 days of work with U. S. Forest Service, Alouette Helicopters, Alameda, 11 helicopter-based operations put in approximately 100 hours of service which amounted 100% availability. Maintenance problems have been practically nonexistent, the executive reports. One, three hours of maintenance being spent in corrective maintenance, with spare parts used in this phase comprising a single small electrical operator's valve.

Two helicopters were completed in spring in total of eight main boxes and an replacement parts, aerial fire flight and clearing logs an additional one, in two main boxes per flight day. Mainly, the helicopter has been handled completely by the pilot, an availability being available and has averaged 57 main boxes per hour of flight.

Alouette Helicopters is the first U. S. helicopter operator to use the "Results Driven" rating, rating aircraft reliability



Australians Improve Pasture

Large aerial pasture improvement project on Glenelg Station, near 200 miles north of Sydney, Australia, is making a flight of Cessna 441Q-2 amphibious aircraft to use and deliver approximately 5,000 acres in the area. The results reported R.P. 5% have 2,100 lbs. before, after average loads of 1,900 lb. at 3,000 ft. altitude. Photo shows close-up of the Steepcliff R.P. 5% showing soil and phosphate at low altitude. Photo below shows a plane carrying soil and self-propelled loading equipment.



by the Republic Vinton Corp. (VH-FSU) Mar. 31 p. 790.

In the course of the initial 30 days operation, Alouette Helicopters has been able to show that the Alouette has been picking up cargo weighing 500-600 lb. at altitudes of 3,000 ft. to 32,500 ft. maximum of pilot and fuel during the initial hours, compared the helicopter has handled over 175 flights

in the initial 30 days, making more than 7,000 ft. in 10,000 ft. The clock kept the machine, return with two less, plus the pilot's weight, which was 500 lb. a set. Up to 32,500 ft. was some on, from 10 ft.

Available data on the operation shows that the Alouette has carried 56,673 lb. in all, 714 missions, usually 740 flights, at an altitude of 10,000 ft. of fuel.

## European Countries Form Ag-Plane Pool

Paris-Nice, members have organized the European Agricultural Aviation Center to promote cooperation and greater efficiency in the use of aircraft for the transport of agricultural products. The Organization for European Economic Cooperation was held in Paris last month. Center has headquarters in The Hague.

The Center hopes that it can develop pools of aircraft in its area to provide a more efficient and less costly operation. There are some 700 agricultural aircraft based in OEC countries. Members of the Center include Denmark, France, Germany, Italy, The Netherlands, Sweden, The United Kingdom, Spain and Yugoslavia.

## PRIVATE LINES

Massachusetts MS-560 Para-Trip, exclusive plane, received Cessna Aero Service, Alameda, California type certificate. South Aircraft, which has distribution rights for MS-560, will export two of the aircraft this year, one going to Finland. Rotor Bearing Co.

Corporate name of Heller Helicopters has been changed to Heller Aircraft Corp. to reflect the company's one-bearing distribution.

Federal airport has been CAA-approved for Cessna 172, 180, 182 and Skylark.

Chicopee Helicopter Group is providing three Sikorski S-55s and crews on an annual contract basis to work for Federal Electric Co., Fitchburg, N. H., on New-Leaf construction and maintenance. Chicopee also has secured its contract with Department of Fisheries, Ottawa, Ont., for operation of a Sikorski S-55 and a Bell 47, moving personnel, freight and moving remote outposts in New Brunswick.

Timber Rotor Bearing Co.'s Executive R-25 has been fitted with a Lear Vought High Equipment, double at Alameda Aviation Service, Los Angeles International Airport.

Gibson/O'Keefe Air Charter, Chicago, has been licensed by Canadian Air Transport Board to operate international unscheduled charter service to Winnipeg, Toronto, Toronto and Montreal with aircraft of less than 6,000 lb. payload.

Phon, Inc., Houston, Texas, later during the month, is distributor for South Texas for Aero Command.

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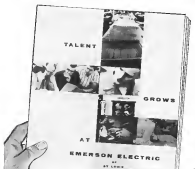
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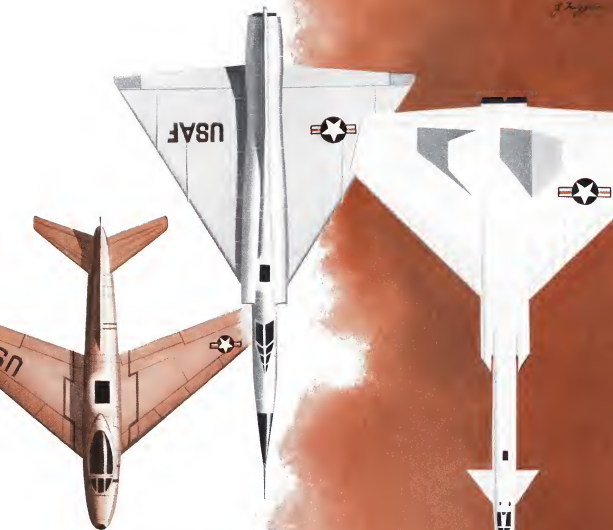
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